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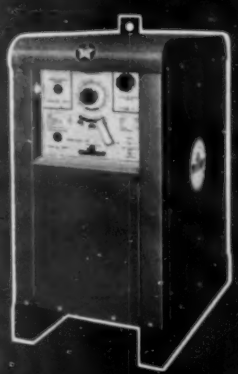

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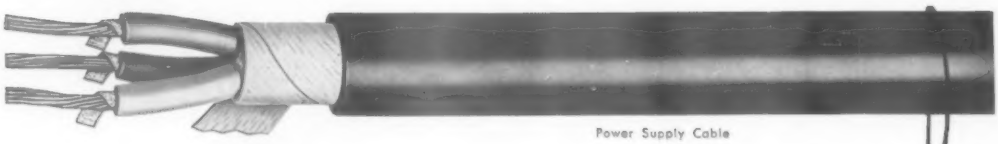

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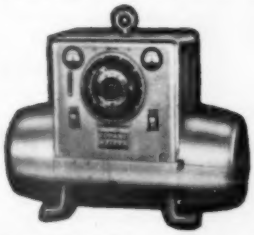

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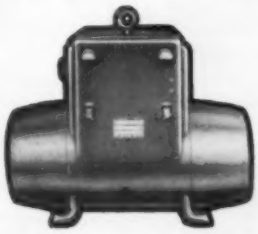

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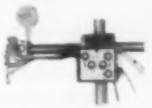

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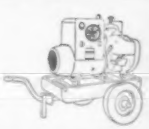

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Vol. 43 — No. 5

Welding Engineer

The magazine of joining and severing materials

This is welding: May, 1958

Take wasted $$ off the scrap pile 31
There's not much sense in scrapping 75 to 85% of expensive metals that have been slightly worn under heavy service conditions. Stulz-Sickles Co. offers you a relatively easy and inexpensive solution.

Is automatic hardfacing for you? 32
▶▶▶▶▶▶ **Spencer Payne** not only answers this question with a firm "Yes," but tells you, on the basis of hardfacing "can's" and "can'ts," just how he arrives at this answer.

Spray and fuse . . . a popular hardfacing method 34
Wall Colmonoy Corp.'s **H. S. Gonser** tells the reader why spray hardfacing develops the molecular bond missing in metallizing techniques, and just how it should be applied.

Rocket plane depends on welding 37
Tig and resistance welding—plus brazing—are cited by North American Aviation, Inc., as the most vital of all joining methods used throughout its new X-15 hypersonic jet, soon to be tested.

Here's how—whenever plowshares must be hardfaced 38
Welding job shop owners in agricultural areas will undoubtedly find much that is valuable in these procedure recommendations by Stoody Co. for the ticklish job of "armoring" plowshares.

Filler metals for joining 40
Orville T. Barnett contributes several pages of very worthwhile material on the characteristics and performance of hardfacing alloys. Data Sheet No. 212 accompanies this article.

"Liquid Cooling": Bernard's answer to hot, slow welding 46
New for manual metal-arc welding, "LC" system equipment drains heat from electrodes to permit higher currents, faster welding, greater deposition.

New automatic process for arc welding steel 49
Developed by Lincoln Electric Co., the "Innershield" process uses a flux-containing, coiled-wire electrode to produce vapor shielding for an open arc—and develops speeds up to 300 ipm.

A hardfacing field-guide for beginners 54
Industry pioneer **D. B. Rankin** lists six important signposts on the road to better hardfacing that every newcomer should learn.

Hardfaced buckets star in underwater mine 68
▶▶▶▶▶▶ Mining hard and abrasive *coquina* on Florida's east coast, Lehigh Portland Cement Co. is in a position to appreciate all that hardfacing can do to lengthen service life of its dragline buckets.

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River towboats sport all-welded stainless hulls 60
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May is now National Ornamental Iron month 70

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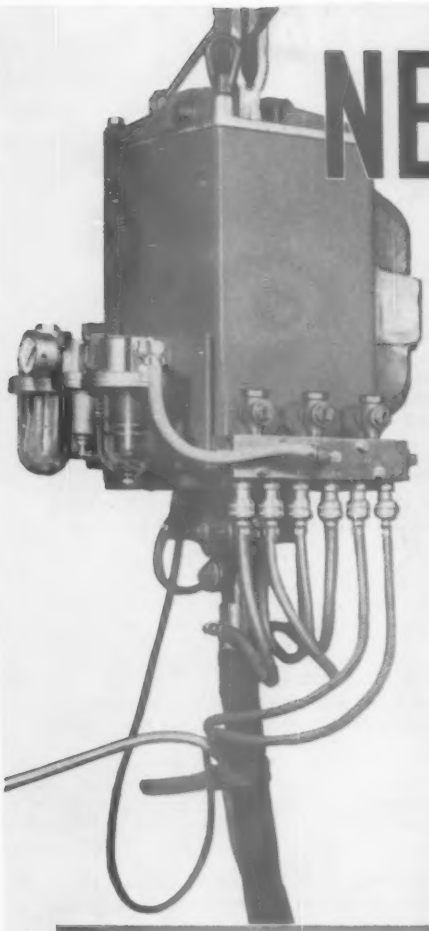

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Shown at the left is the fiber glass safety cap, worn visor in back. The Jackson fiber glass welding helmet is shown held by Jackson's exclusive friction pivots with wing nuts, adjustable while helmet is worn.

New—All purpose Plastic Safety hats comply with Federal Specifications for construction workers' hats and Edison Institute requirements for linemen. The Life Guard cap, shown here, like Jackson's fiber glass safety caps, is also available in helmet and goggle combinations, and with Musketeer headgear and visors.

Jackson Helmet H1-AP

This Welding Helmet, with Adjust-O-Lok headgear and plastic lens holder is one of 18 models. Nylon, wear-resistant and insulative, is used for headband, friction pivots and large, winged knob adjusting mechanism.

Helmet shell is of fiber glass plastic. Strong, light, highly resistant to moisture, it holds its shape, lasts many times longer than old-style helmets. Lens holder, of high-impact plastic, is insulative, heat resistant. No metal parts protrude, so no current can pass shell or headgear.

Three styles of helmets are offered pivoted to the Jackson Safety Cap. Type SCH-4 shows white cap and narrow shell helmet, lift-front lens holder.

Type WR-70

The Supergoggles (shown left) are one of three series of Jackson Goggles. A true cover-all style, they're wider, without being bulky, to be worn over today's larger prescription glasses and safety spectacles. Larger inside areas, well ventilated, make them cooler, more comfortable.

Made with elastic headband or plastic headrest, for *gas welding*, or, with clear hardened lenses, for *chipping* and *grinding*.

Cap-and Goggle combination shows Unigoggle for gas welding. Springs in telescopic arms hold goggle up or down.

Musketeer Headgear with Visor No. 39

New Musketeer headgear, durable and convenient, has Nylon headband and pivots, both adjustable while in use. Cross strap adjusts to height; wide spark deflector carries a choice of visors. Shown: fiber visor with welding lens for scarfing. Also several sizes of plastic visors, clear or in shades of green, and a wire screen visor.

Hat and Face Shield combination has hinged visor 15½ x 9" in clear plastic or in shades of green.

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NEWS

"CHEMETRON," new name of NCG, is held aloft by President Haines and technician Henry Howell.

Name change for NCG Co.; becomes "Chemetron Corp."

Welding and cutting equipment, chemical products, process plants for the chemical and petroleum industries —these are a few of the products made by National Cylinder Gas Co. of Chicago. With 81 plants in the U. S., and 14 in other countries, the company has branched into several fields, and—in the process—outgrown its 24-year-old title "National Cylinder Gas Co."

Last month the firm's directors voted to change the antiquated name, and asked stockholders to approve the title "Chemetron Corp." (Made up of syllables from three of the major industries served by the company—*chem*icals, *me*tals and elec*tron*ics.)

The firm recently established an NCG Div. of National Cylinder Gas Co. in Chicago. The division will continue to supply industrial and medical gases and equipment—and to fulfill the connotations of its name. As soon as the parent company assumes the new name, the division will be known as the "National Cylinder Gas" division.

The search for a suitable name lasted five years. From thousands of names collected, a list was turned over to a consulting firm specializing in naming new products and firms. The new name, officials decided, should 1) be short and simple, easy to remember 2) be easy to pronounce, in just one way and 3) not misrepresent nor infringe on other firm or product names.

A list of possible names was submitted to hundreds of men and women. The aid of an electronic computer was enlisted, and 22 consonants and vowels fed into the computer resulted in 37,000 combinations (many unpronounceable.)

From three "finalists," the name "Chemetron" was the overwhelming choice, Chemetron Corp. reports.

Female engineers take to the torch

At Bradley University in Peoria, Ill., four freshman women have invaded a man's field—engineering. Part of their training includes learning how to wield a welding torch.

Welding is a first-year required course for students working for degrees in mechanical and industrial engineering. They spend three hours a week in the welding shops. The course is not intended to teach competency, says Dean Russell Gibbs of the College of Engineering, it is to teach familiarity with the capabilities and limitations of welding as a means of manufacture or fabrication, and to serve as a guide in heat treatment.

Supersonic steel wins design award

First prize in a nationwide product design competition for the best use of materials went to Ryan Aeronautical Co., San Diego, for its new "MiniWate" method of fabricating paper-thin, high-strength steel alloy into strong structures able to resist supersonic heat friction. *(See April* WELDING ENGINEER, *p. 40)* Bruce Mitchell, chief of the structures section, spearheaded the three-year research program which produced "MiniWate." He received the $500 first prize and a plaque.

BRUCE Mitchell displays the strong, light structures of the design which won first prize in a nationwide competition for the best use of materials. Some of the heat-resistant stainless steel alloys are only .002 in., two-thirds the thickness of a newspaper. (See story)

COEDS — freshmen at Bradley University, Peoria, Ill.— don weldor's masks and gloves to learn how a welding torch works. (See story)

WELDING pipe members in Germany is a large scale job, reports Phoenix-Rheinrohr, A.G., of Dusseldorf.

LEFT to right, Walter I. Gray of Linde Co. explains a unit's instrument panel to U.S. Steel's Charles I. Hunter and George Krapf. (See story)

Engineering firm gets L&B welding chambers

Scientific Engineering Laboratory, Berkeley, Calif., has acquired the inert atmosphere welding chambers originally designed and constructed by L&B Welding Equipment Co., also of Berkeley. Scientific Engineering has been closely associated with L&B, and supplies the vacuum pumping requirements for the inert atmosphere welding chambers. Clifford F. Leader is with Scientific Engineering as engineer in charge of design of the equipment.

Allen makes way for superhighway

With a new superhighway coming through its old location in Chicago, the L. B. Allen Co., Inc., is moving to 9329 Berenice in Schiller Park, Ill., part of the metropolitan Chicago area.

U.S. Steel gets oxygen plant

At U. S. Steel's South Works in Chicago, Linde Co. has built a new oxygen producing plant able to produce 48,000,000 cu ft a month. The oxygen will be used for cutting, scarfing and scrap preparation.

The Linde-operated plant is designed for automatic operation. Through a control system, the plant will automatically produce oxygen at the rate required by the mill's operation, pump oxygen into storage tanks for standby and peak requirements and regulate operation of the valves, meters, motors, etc. A monitor system warns of any possible trouble.

Contest offers $2,000 in prizes

The Resistance Welder Mfg.'s Association is sponsoring a contest in the field of resistance welding. For winning papers in special projection welding or general welding classifications, $2,000 in prizes will be awarded.

The contest closes September 15. Applications should be received by July 1. For contest rules and author's application form, write to Resistance Welder Manufacturer's Association, 1900 Arch St., Philadelphia 3, Pa.

Metal Congress meets in Dallas

The American Society for Metal's first Southwestern Metal Exposition and Congress takes over in Dallas May 12 through 16. Emphasis is on aircraft materials, fabrication techniques, high temperature steels and alloys and metals problems in the petroleum and chemical industries, says ASM secretary W. H. Eisenman.

Scientific presentations are scheduled on the ASM program, and the Society for Non-Destructive Testing is giving a four-day technical program.

M&T celebrates golden anniversary

In 1908 the Goldschmidt Detinning Co. was founded to utilize a European process for reclaiming tin and steel scrap from the tin plate scrap

(Continued on page 87)

LARGEST fractionating tower ever built at Salt Lake City is 95 tons, 79 ft long. Here it moves out of Chicago Bridge & Iron Co.'s plant bound for Utah Oil Refining Co.'s refining facility. Two 20-ton cranes lifted the 15 ft diameter tower onto the rail flatcar. Unit is welded.

PRESENT at the University of Wisconsin's recent "Institute on problems encountered in welding of alloys," were, left to right: Experts Thomas McElrath, J. F. Deffenbaugh, Gordon Wepfer, Lynn J. Christensen, Howard Adkins, and T. B. Jefferson, publisher of WELDING ENGINEER.

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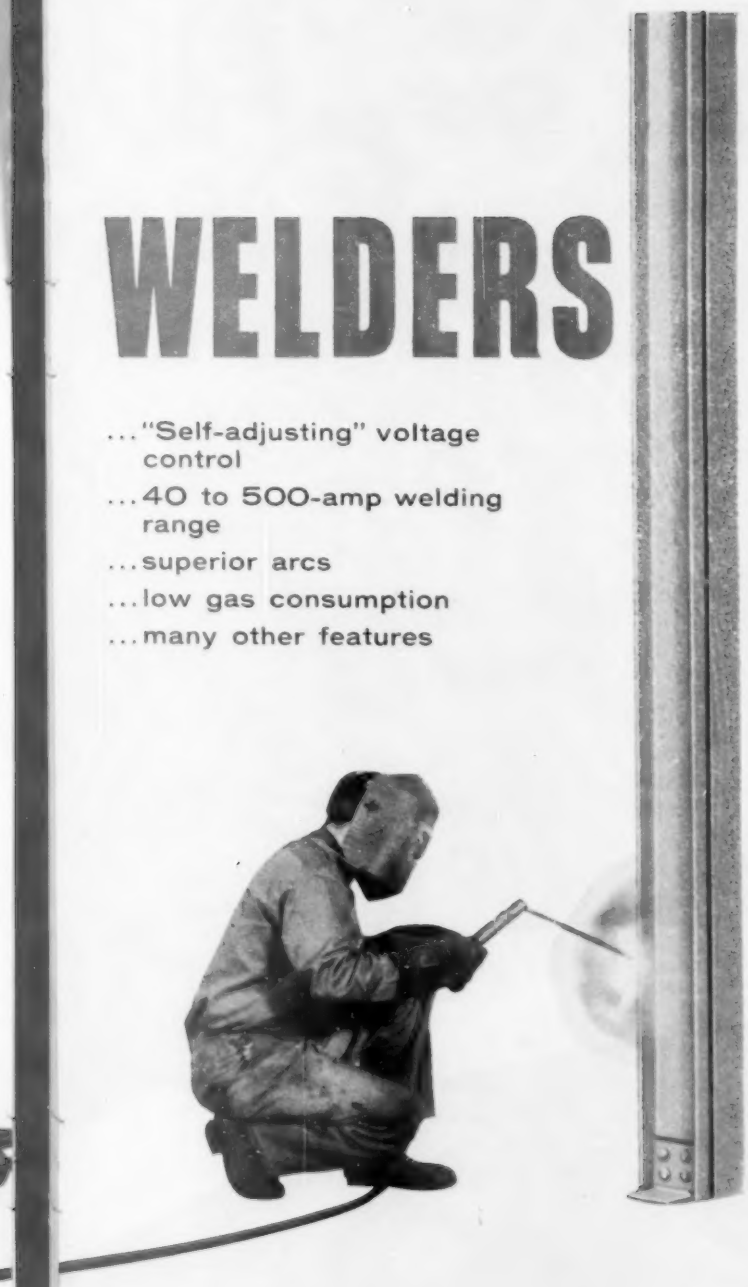

The new P&H engine-driven welders combine rugged, simple design with superior welding characteristics for long-life, low-cost welder operation. Elimination of non-essential parts and easy access to all adjustments simplify operation in the field — assure a self-contained source of dependable power for heavy-construction, pipeline, maintenance, and repair welding. Other benefits include:

- Available in 200, 300, and 400-amp sizes — skid or trailer mounted.
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- Powerful Hercules engine—permits full-shift operation — with gas to spare.
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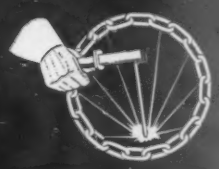

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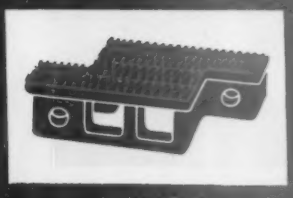

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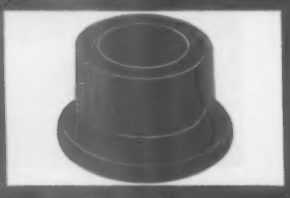
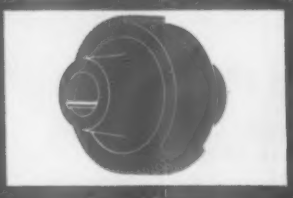
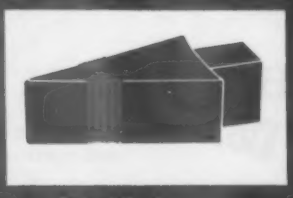


Ditcher Rollers
TUBE-ALLOY 252



Shovel Rollers
TUBE-ALLOY 258



Shovel Bucket Teeth
TUBE-ALLOY 218

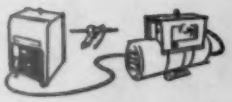
MAY
1958

Your

Weld World

at press time

Last minute news of interest to those engaged in joining and severing materials.



. . Lukens Steel Co. enters electrode field on July 1 when it will will become first steel producer to market complete range of arc welding electrodes to match its range of plate materials. Chicago and Coatesville (Pa.) sales offices will accept orders beginning that date for alloy and mild-steel electrodes precisely suited to Luken plates. Firm expects to distribute new electrodes nationally shortly thereafter.

. . Watch for startling new developments in not-too-distant future in arc-welding equipment which will result in more satisfactory a-c and d-c rectifier machines at lower cost.

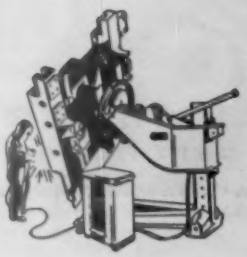
. . Good news for government purchasing agencies is in offing. They can expect a new specification that will greatly simplify buying of arc-welding electrodes.

. . Electrode prices are on their way up again. Price change this time will include different price structure.

. . Business picture is still confused, with certain industries and areas professing alarm, while others exude optimism. But tax cut opponents are expected to have their way. Washington is playing a waiting game.

. . More than 1,500 persons were registered at second Santa Clara Valley AWS welding show recently held in San Jose, Calif. Forty-five manufacturers were represented in 22 booths. With this and similar shows on increase, is trend toward smaller sectional shows?

. . Merger between two X-ray manufacturing firms is in the "talking" stage.



. . Du Pont has reduced prices on two grades of ductile titanium metal sponge. Cuts are from 15 to 20 cents per pound.

. . Air Reduction Co.'s sales and earnings in 1957 reached record highs. Sales were 12% over 1956; income 5%.

the most complete stainless line in welding

- Well over 400 stainless electrodes to meet every known need for welding stainless or dissimilar metals
- All 3 types of electrode coatings—DC Titania, DC Lime and AC-DC Titania
- Choice of bare wire (straight cut, coiled or spooled), or coated electrodes.
- Continuing development program for formulating new Murex Stainless Electrodes to satisfy special engineering requirements

..backed up with a complete service package for the welding engineer

- Time-seasoned, weld-wise field representatives for personalized, on-the-spot service
- "Special Problems Staff" backing up our field representatives for assistance on unusual stainless applications
- Adequate stocks strategically located for ordering convenience
- Helpful, informative technical literature

NEW STAINLESS FACT FILE NOW AVAILABLE!

For reference material prepared to aid you in your stainless welding operations write for the MUREX Stainless Fact File just printed . . . If you have a specific problem we will be glad to help.

METAL & THERMIT
CORPORATION
GENERAL OFFICES: RAHWAY, NEW JERSEY

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TODD NEW YORK, U.S.A.

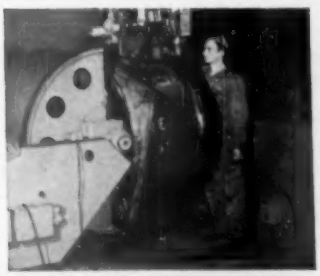
FOSTER WHEELER

BETHLEHEM STEEL

GENERAL ELECTRIC COMPANY

WHY 93 OUT OF 100

leading corporations use Worthington positioning equipment



Worthington welding positioner in Foster Wheeler's Mountaintop, Pennsylvania, plant.

It's a fact. Of the 100 largest industrial corporations listed in the latest Fortune Magazine Directory, 93 are users.

One reason why leading manufacturers have turned to Worthington is good service. With distributors in all principal cities, a Worthington specialist is always nearby to help solve your positioning problems.

Conservative ratings are another. Refusing to compromise with quality, Worthington engineers positioners to deliver, year after year, the rating stamped on the nameplate.

Pick your next positioner from Worthington's complete line. For more information write to Section 55-1, Worthington Corp., Harrison, N. J.

WORTHINGTON

AO486A
FLEXIBLE MASK GOGGLE
with Filter Lens Adapter

Larger face mask for greater protected area . . . deeper cup for increased lateral protection and easy fit over all safety R glasses and personal glasses . . . modified nosepiece for greater comfort — these are highlights of this new goggle for welders. Lens adapter is black, flame-resistant nylon — accommodates our standard lens ring and regular 50 mm. round filter lenses and cover lenses. Rings and lens adapter are quickly removable and replaceable. Frame is soft, face-hugging vinylite. Indirect ventilation ports prevent fogging.

RECOMMENDED FOR
acetylene welding, cutting, burning, brazing and furnace work against harmful light rays, glare, flying sparks and scale. Goggle is fitted with Noviweld filter lenses, shades 3, 4, 5, 6. Your nearest AO Safety Products Representative can supply you.

Always insist on the AO Trademark on lenses and frames

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

1833-1958 • 125 LEADERSHIP YEARS

SOUTHBRIDGE, MASSACHUSETTS
Branches in Principal Cities

for machine gas cutting with natural gas at low pressure

3 NEW AIRCO TORCHES!

Also suitable for city gas, propane, and liquefied petroleum gases under pressure

with these outstanding features:—

- Simplified Ease-on oxygen valve permits fast or slow opening.
- New type tip design permits tip nut to be tightened by hand.
- Mixing of fuel gas and preheat oxygen within the torch.
- Operation without booster.
- 1⅜" barrel that fits all AIRCO torch holders.
- Demountable handle that permits rack to be used in any of four positions.
- Seven straight bore type tips cut steel up to 16" thick.
- Eight divergent type tips cut steel up to 8" thick.

Style	Overall length	Type	Type Airco equipment to be used with
2540 2550	13" 14"	2 hose 3 hose	Radiagraph, Camograph Monograph, Pipe Cutting and Beveling Machines
2560	25½"	3 hose	Travograph, Oxygraph, Duograph

Complete information is now available on these new Airco Natural Gas Torches – data sheets, cutting charts, operating manual. Look in the yellow pages of the phone book under "Welding Equipment" for the Airco office or Airco Authorized Dealer nearest you—or write Airco direct.

AIRCO®

Offices and dealers in most principal cities

AIR REDUCTION SALES COMPANY

A division of Air Reduction Company, Incorporated
150 East 42nd Street, New York 17, N. Y.

On the west coast — Air Reduction Pacific Company
Internationally — Airco Company International
In Cuba — Cuban Air Products Corporation
In Canada — Air Reduction Canada Limited
All divisions or subsidiaries of Air Reduction Company, Inc.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: AIRCO – industrial gases, welding and cutting equipment, and acetylenic chemicals • PURECO – carbon dioxide – gaseous, liquid, solid ("DRY-ICE") • OHIO – medical gases and hospital equipment • NATIONAL CARBIDE – pipeline acetylene and calcium carbide • COLTON – polyvinyl acetate, alcohols, and other synthetic resins.

Welding Wire: Cost-saving

• Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus better performance of the finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves our customers time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by nearby PAGE warehouse stocks, help make it economical and profitable for you to standardize on PAGE Welding Wire.

PAGE offers—
33 ANALYSES
...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc ...inert gas...tungsten or metal arc...oxy-acetylene gas welding.

For example—

ANALYSIS A-S-8620...A-S-8620 is a balanced low alloy containing chromium, nickel and molybdenum. For this reason it is sympathetic towards almost all other low alloys containing one or more of the above elements and can be used even when the exact analysis of a low alloy is not known. It also responds to heat-treatment in the same general fashion as other low alloys. Its physical characteristics as welded depend on the type of welding and the heat input. With inert gas (Argon) a 1/16" wire weld deposit will give 80,000 p.s.i. and 40% elongation whereas 5/32" A-S-8620 wire used with submerged arc flux will give 115,000 p.s.i. and 15/20% elongation. A-S-8620 is much used in welding the new T-1 Steel in tank-trucks, earth-moving machinery, guided missiles, etc. It is relatively inexpensive and available for quick delivery on reels, in layer-wound coils or in straightened and cut lengths for inert gas, submerged arc and oxy-acetylene welding.

For example—

ANALYSIS A-S-6150...This grade of welding wire is a low alloy hard facing rod. The hardness and wear-resisting properties are given by the relatively high carbon content and the presence of chrome and vanadium. When deposited by inert gas metallic arc method (it can be used as submerged arc filler metal), the Rockwell hardness as welded is C-31 or C-32. This is on a double overlay pass on base carbon steel of Rockwell C-16 hardness. This deposit may be machined at slow speed using carbide tools or ground to desired contour. In use under impact or abrasion, the surface work hardens without spalling or cracking, up to Rockwell C-40.

Analysis A-S-6150 is widely used in steel mills for building up rolls, in resurfacing caterpillar tractor lugs, on switch points, frogs, etc., mine car wheel rims and flanges—in fact, anywhere resistance to impact and abrasion are required.

NOTE • ***Look to PAGE, not only for automatic welding wire, but for gas welding rods, bare electrodes and metal spray wire***

Write for—Welding Wire **Comparison Chart DH-1218-M** (shown above) • Submerged Arc and Inert Gas Welding Wire **Folder DH-402A** • Gas Welding Rod **Booklet DH-1277**

This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects...and insuring trouble-free, economical, profitable operation.

and Profit Factors

PAGE offers— Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. Paper Wrapped Coils 2. Coils in Cartons, Palletized
3. Bare Coils (packed in Leverpaks)
4. Masonite Reels 5. Payoffpaks 6. Payoffpallets
7. Gas Rods in Burlap-wrapped Bundles
8. Stainless Gas Rods in 10-lb. Tubes

For example— PAYOFFPAKS

Up to 700 lbs. of wire, without a single weld...coiled around a fiberboard cylinder within a fiberboard drum ...ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoffpaks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).

Wrapped Coils—Coils in Cartons | Welding Wire in Coils | Handy Reels | Gas Rod Packing | Payoffpaks and Leverpaks | Payoffpallets

This Chart Shows How PAGE Offers The Exact Packaging You Want	Gas-shielded consumable electrodes		Filler wire for automatic or manual Inert Gas Welding	Submerged Arc Welding	Straight and cut lengths Bare wire	
PACKAGING ▼ PAGE WIRE for ▶	Automatic Welding	Semi-Automatic Welding			Manual Electric Welding	Oxy-acetylene Welding
25-lb. or 60-lb. coils wrapped in waterproof paper, steel-strapped, single or palletized.	✔	✔	✔	✔		
25-lb. or 60-lb. coils in individual cartons, single or palletized.	✔	✔	✔	✔		
120 or 180 lb. (22"/24" I.D.) coils, paper-and-burlap wrapped, or in cartons, palletized.	✔			✔		
Special coil sizes (on application).	✔	✔	✔	✔		
25-lb. reels (spools) in carton to fit all standard machines; single or palletized.	✔	✔	✔	✔		
Leverpaks, 15" dia., 25-lb. coils (12" I.D.x2½" wide); Leverpaks, 17" dia. 50/60-lb. coils (12" I.D.x4" wide).	✔	✔	✔	✔		
Payoffpaks: 20" dia. size holds up to 500 lbs.; 23" dia. size holds up to 700 lbs.	✔	✔		✔		
Payoffpallets, holding 900-1200 lbs. of wire (⅛" to ⅜" sizes, incl.) coiled around pedestal on a wooden pallet.				✔		
Paper-and-burlap wrapped bundles, containing 50 lbs. of rods in 36" lengths.			✔			✔
Fibreboard cartons, containing 10 lbs. of rods in 36" lengths; single or boxed. 50s and over.			✔			✔
Burlap-wrapped 50-lb. bundles of bare wire electrodes in 14" and 18" lengths.			✔		✔	

Write for—PAGE Welding Wire Packaging Chart

This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

Now—about Delivery... PAGE offers— Availability from local stocks

• Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

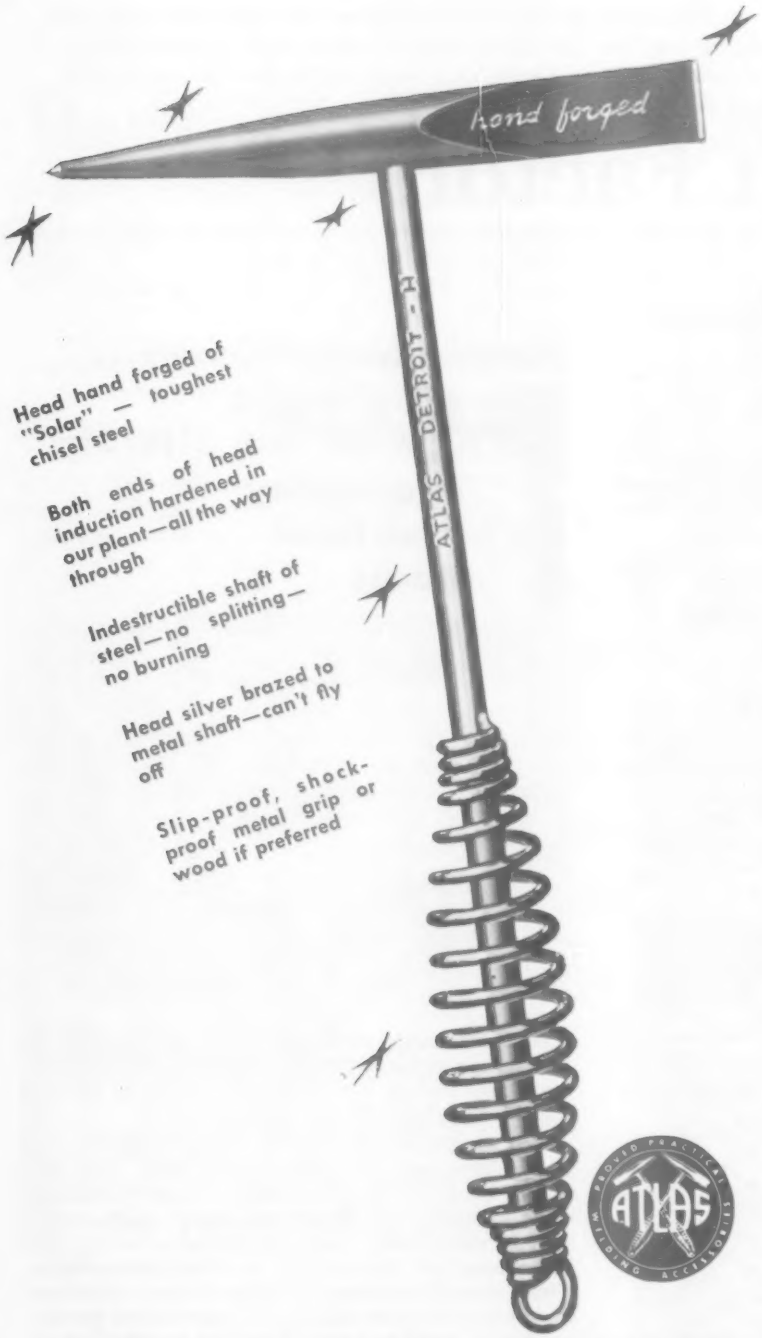
ACCO

Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston* Los Angeles*, New York, Philadelphia*, Portland, Ore. San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

ACCO for Better Values


Head hand forged of "Solar" — toughest chisel steel
Both ends of head induction hardened in our plant—all the way through
Indestructible shaft of steel—no splitting—no burning
Head silver brazed to metal shaft—can't fly off
Slip-proof, shock-proof metal grip or wood if preferred
Hand forged
ATLAS DETROIT - H
ATLAS
PROVED PRACTICAL WELDING ACCESSORIES

YOU CAN'T BEAT ATLAS TOMAHAWKS FOR QUALITY!

Ask your welding supply dealer to show you the Atlas line of weld cleaning tools. Whatever the nature of your job there's an Atlas tool designed for it. Welders like them, their balance and feel and get better production with them.

ATLAS WELDING ACCESSORIES INC.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Canadian operation

Sir: *Chester, Pa.*

You should understand that Fibre-Metal (Canada) Ltd. is an independent company in which the Fibre-Metal Products Co. happened to have a financial interest and representation on the board of directors. Gil Doyle is general manager, and also a director of the company.

Because of the separation between the Canadian market and the market in the States, and probably also because of our serious interest in establishing better distribution of our product in Canada, the Fibre-Metal name has been used by our Canadian warehouse.

I would like to stress again that Fibre-Metal (Canada) Ltd. is an independent company and will also handle, on a warehouse basis, other related but non-competitive lines. Fibre-Metal (Canada) is unique from the standpoint that it is the first genuine wholesale distributor in Eastern Canada. It has absolutely no relation to retail selling of our products, or related products, and as such acts simply as a source for the distributor who sells to the consumer. It is well known that a number of U. S. companies, related to our trade, have established independent Canadian operations. However, a closer inspection of these operations will show that they are all engaged, in some part, in selling to the consumer.

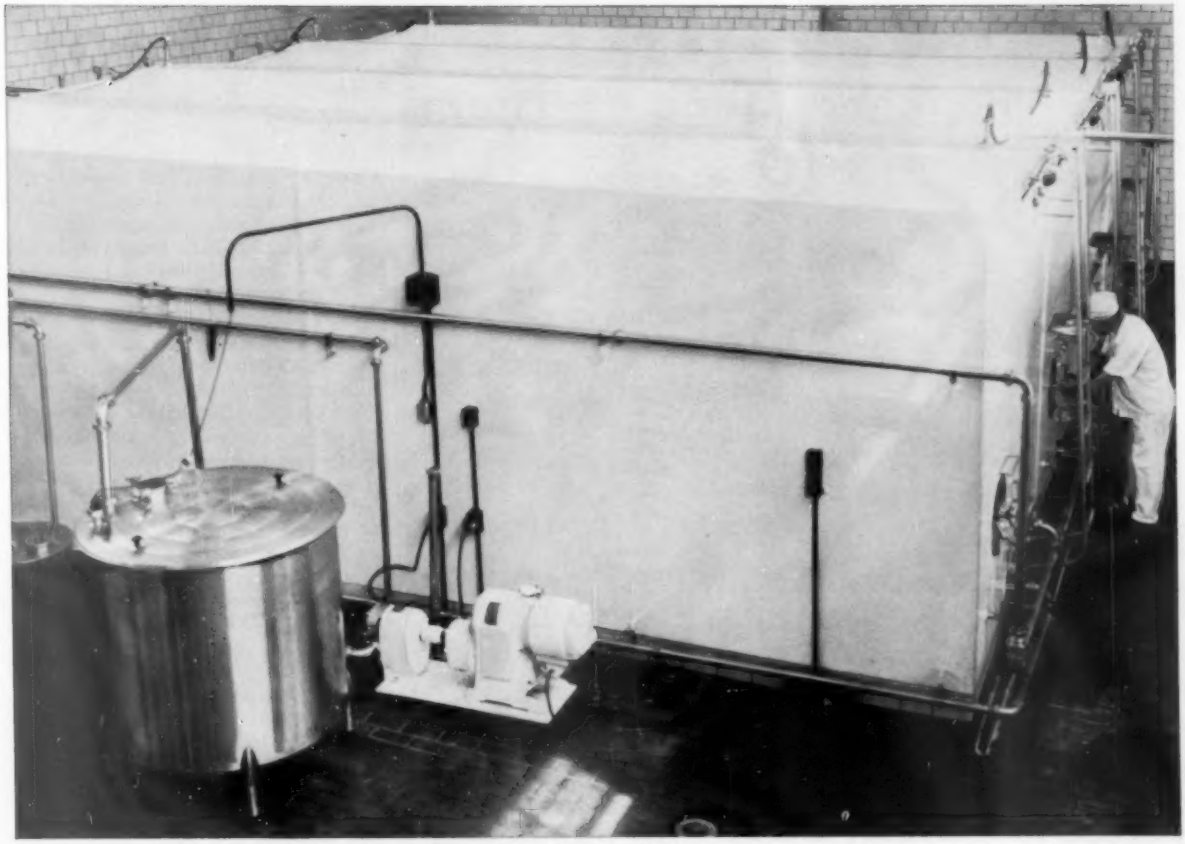
Charles E. Bowers, Jr.
Sales Manager

Much improved

Sir: *Detroit*

We feel that WELDING ENGINEER and THE WELDING DISTRIBUTOR are much improved over the past couple of years, and we particularly like *The Welding Line* and *Just For the Sell of It*, in the Distributor, and *WeldWorld* in the Engineer.

H. E. Piggott, president
Dockson Corp.



Modern dairy equipment by PFAUDLER welded with

ARCALOY

STAINLESS STEEL ELECTRODES

Pfaudler dairy "rectangulars" are reinforced with exterior walls of steel plate. The inner stainless liner, welded with Arcaloy electrodes, is insulated from the outer sheathing.

The Pfaudler Co., as designers and fabricators of glassed-steel and alloy process equipment specify Arcaloy Stainless Steel Electrodes for welds in their stainless dairy storage tanks and chemical equipment. Arcaloy Electrodes provide the necessary X-ray quality weld metal, color match and smooth even bead required for these quality products.

What are your stainless steel electrode requirements . . . corrosion resistance, strength, appearance? Arcaloy Stainless Steel Electrodes are your answer for consistently better results. There are over thirty different grades in lime or AC-DC (Titania) coatings to meet your most exacting requirements. The Arcaloy Selector Guide is your aid to superior quality stainless welds. Write for Bulletin AR-10-2, Alloy Rods Co., P. O. Box 1828, York 2, Pennsylvania.

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

Alloy Rods Co.

NO FINER ELECTRODES MADE . . . ANYWHERE

ONE WELD--
or a Thousand Miles of Them

Magnaflux inspection of weld on refinery reactor during erection.

Speed and ease of Magnaflux speeds pipeline weld tests, and tests 100% of weld!

To get fast--positive--low cost inspection

Call MAGNAFLUX

NATION-WIDE
SCIENTIFIC
INSPECTION SERVICE

Anywhere--Anytime

When you need weld inspection you can depend upon — in the field or in your plant — *call us.* You'll have a Magnaflux factory-trained Commercial Inspector or team on the job — pronto!

These expert men, working with all Magnaflux Test Systems (Magnaflux-Magnaglo, Zyglo, Sonizon Ultrasonic and others), and with Gamma Ray, find every defective weld that *needs* to be found.

The cost — usually a few cents or less per foot of weld! It is just as important to you that they recognize *good* welds as spot the bad ones.

Then, by showing not only *what* and *where,* but *how* defects occur, they help welders do a better job. This cuts your welding costs — assures consistent quality at a practical price.

FOR TESTING BIG THINGS such as pressure vessels, heavy machinery, piping and pipelines, structural members, *Magnaflux Field Inspectors* brings a mobile "shop" right to the site.

IN THE FIELD OF NUCLEAR ENERGY, this test service offers the most positive detection known for locating the weldment leaks that are of such vital concern. In any kind of maintenance inspection Magnaflux Test Systems mean safety.

FOR SMALL PARTS WELDMENTS, use your nearby *Magnaflux Commercial Inspection Plant.* Testing here is low in cost for any quantity—gives you the benefit of a *nation-wide standard inspection* that helps you build welding business through accepted evidence of quality. Write for new bulletin.

TO GET, USE OR BUY BETTER WELDING AT LOWER COST — write for details . . .
or call any of the COMMERCIAL INSPECTION BRANCHES SHOWN BELOW

HALLMARK OF QUALITY IN TEST SYSTEMS

MAGNAFLUX CORPORATION
7342 West Lawrence Avenue, Chicago 31, Illinois

Mineola, L. I., N. Y. Pioneer 7-3220	Philadelphia, 33 BAldwin 3-5500	Detroit 11 TRinity 3-4343	Dallas 35 FLeetwood 2-2626
Newark 4, N. J. HUmbolt 3-1235	Pittsburgh 36 TUxedo 2-3448	Indianapolis 18 LIberty 7-1303	Houston 21 WAlnut 3-9169
E. Hartford, Conn. BUtler 9-2737	Cleveland 15 HEnderson 2-0727	Chicago 39 EVergiade 4-1561	Oakland 8 OLympic 8-0201
Bridgeport, Conn. EDison 6-2113	Cincinnati 23 MUlberry 1-6436	Los Angeles 22 RAymond 3-8961	Van Nuys STate 5-8640

Welding in Germany

Sir: *Dusseldorf, W. Germany*

We read your article, "The New Frontier in the Welding Industry" in the January, 1958 WELDING ENGINEER with a great deal of interest. We were especially pleased to see your just analysis of West Germany's business situation and your favorable analysis of its market possibilities.

But we would like to make some supplementary remarks concerning your observations on the German welding industry. You have taken the Machine Tool Exhibition in Hanover as a scale by which to measure the development of the welding industry in Germany. It is true that few firms specializing in welding took part in that exhibition. Most welding firms refrained from exhibiting because they had already done so at "Schweissen und Schneiden," the German Welding Association show in June and July, 1957, in Essen. We believe this was one of the world's largest shows specializing in welding. It offered the technical world pertinent information on the tools and technical methods of German welding.

The international technical press found it exhaustive professionally. (We refer to the lead account in the Russian technical journal, "Swarotschhoje Proiswodstwo.") The Western world also positively approved of this technical show. Our American colleagues, with whom we work in the International Institute of Welding, visited the exhibition and were outspoken in their praise. The echo of this show was particularly resounding in the international technical world; especially so because, at the same time—June and July—the International Congress of the IIW was being held in Essen and, therefore, it was possible for many foreigners to visit the exhibition.

Automatic welding techniques also are of considerable importance in Germany. Importance must be granted to its growing use, as well as to technical methods and applications. In this respect, your article could lead to a false conclusion by passing over the actual circumstances in Germany.

The German Welding Assn.

Our goal, too

Sir: *Cleveland, Ohio*

Why is there not more teaching of welded design (machine design and structural design) in the various engineering schools in the country?

A. F. Davis, vice president
Lincoln Electric Co.

—Same question we've been asking for lo, these many years.

Worn cast iron paper stock pump

...repaired with Ni-Rod "55" electrode

...goes right back on the job

New "lease on life" for iron castings with Ni-Rod "55" electrode

When workers at Austell Box Board Corp. in Georgia pulled this cast iron slurry pump for inspection, they found the inner shell (above left) chewed up by abrasion, with finger-size cracks and gouges.

Scrap it? Not on your life. Down at Austell, they *repair* iron castings. Do it easily with Ni-Rod "55"* electrode.

First, surfaces are thoroughly cleaned. Then cracks and worn areas are filled with Ni-Rod "55". Use of metal arc process enables the welder to operate in close quarters without difficulty.

No pre-heat or post heat is needed. Slag chips off easily after each pass. In a short time the pump's back on the job.

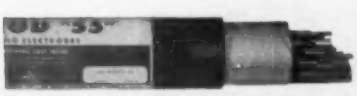
Helpful booklet answers many welding questions

"A Handy Guide to Welding Cast Irons" illustrates the many different repair jobs you can do with Ni-Rod "55". It also covers technical data and gives helpful welding tips. For your copy, just write Inco.

*Registered trademark

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO
TRADE MARK



INCO WELDING PRODUCTS

ELECTRODES • WIRES • FLUXES

COLMONOY®

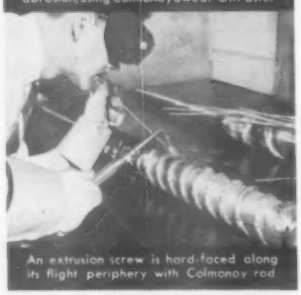
HARD-FACING ALLOYS

The closer the match between the characteristics of a hard-facing alloy and a given wear problem, the more successful the application. Colmonoy stands for a complete line of hard-facing alloys. Colmonoy iron, cobalt, and nickel base alloys provide a wide range of capabilities from which to choose. They provide wear resistance for everything from jet plane tail skids to oil field pump plungers.

The form and method in which an alloy is used can greatly affect the cost of the application. Colmonoy alloys are applied in other ways as well as by the usual oxy-acetylene and electric arc methods. They can be sprayed on in powder form, and subsequently fused to the base metal. This provides a non-porous welded overlay that reduces application and finishing time. They can also be applied as castings, as in wear strips and other special shapes. The basic Colmonoy constituent, chromium-boride crystals, can be applied in paste form, and fused into the base metal with an oxy-acetylene torch. In choosing a hard-facing alloy, the Colmonoy line can not be safely overlooked.

A pumpshaft hard-faced with powdered Colmonoy alloy and the Spraywelder.

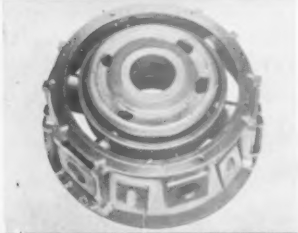
A cultivator sweep is protected against abrasion, using Colmonoy Sweat-On Paste.



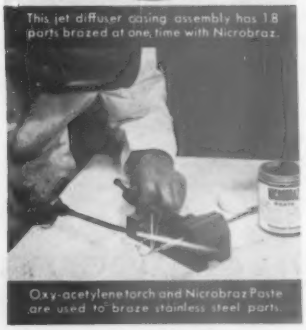
An extrusion screw is hard-faced along its flight periphery with Colmonoy rod

Write and request the Colmonoy Hard-Facing Manual and Spraywelder catalog. Engineering Data Sheets are available for specific applications. Outline your wear problem for a Colmonoy recommendation.

Our 72-in. diameter hydrogen atmosphere furnace being lowered over a loaded bell.



This jet diffuser casing assembly has 18 parts brazed at one time with Nicrobraz.



Oxy-acetylene torch and Nicrobraz Paste are used to braze stainless steel parts.

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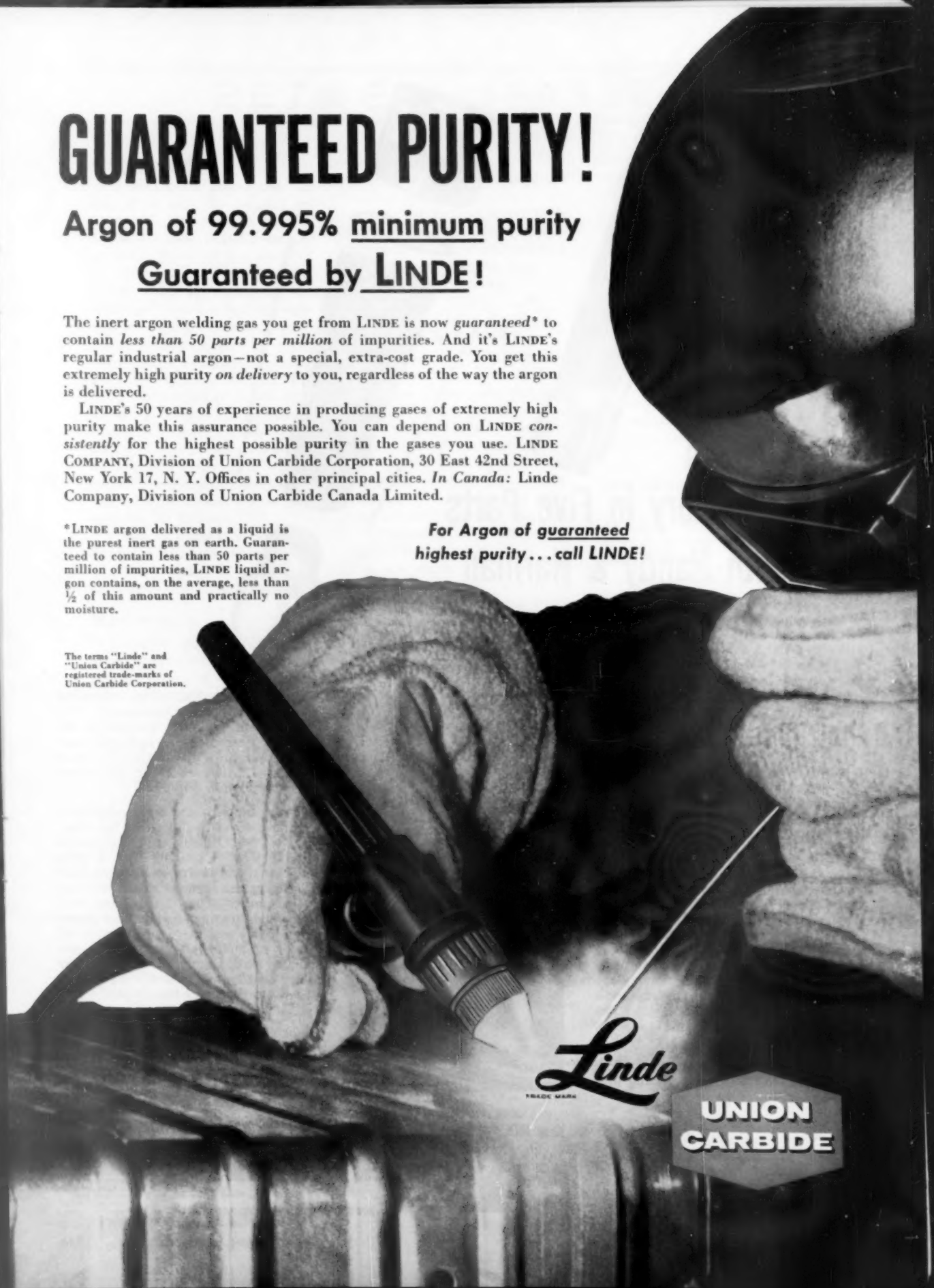

A Brazing Story in Five Parts ...with Handy & Harman EASY-FLO

The Perlman Heat Treating Corp., Westbury, Long Island, brazes aircraft fuel system parts for WEBA, Inc. One of these is a fuel filter screen. It consists of five parts: two stiffeners, a screen and two end fittings, all of 302 stainless steel. All of these parts are joined by EASY-FLO silver brazing, using both induction and hand-torch heating methods.

A novel feature is the induction heating method used to braze the two stiffeners to the screen. It is sort of an "upside-down" method, through an asbestos board and carbon block, on which the screen rests with the EASY-FLO wire preform preplaced. The board and block permit enough passage of heat to melt the alloy to the mesh and stiffeners without excess overflow. Because the alloy won't wet the carbon block, the result is a clean, finished fillet.

The larger, cage-type fitting is HANDY-FLUXED, as is the circular preform of EASY-FLO, then assembled and placed in an induction coil. The smaller end fitting is inserted in the screen, preheated by induction and then torch-brazed, with the alloy being hand-fed. Alloy cost for the entire assembly is ten cents.

The main point here is the adaptability not only of the alloy, but the *brazing method.* Hardly anything stands in the way of brazing that a little ingenuity can't solve, as Perlman Heat Treating has demonstrated. We'll be very glad to bring the full and very beneficial brazing story to your attention. More and more, people with all kinds of metal-joining problems are finding that Handy & Harman silver alloy brazing has most of the answers. Answers that may benefit you.

FIRST, BULLETIN 20 — This informative booklet will get you off to a good start on the values, techniques and economies of low-temperature silver brazing. A copy awaits your request.

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BETWEEN PASSES

another curb

We should be getting used to kicks in the teeth, but we guess we never will. The latest in governmental decisions denying welding the status of a craft was made by the National Labor Relations Board, which in a decision last month said "weldors are appropriately represented by the craft union having jurisdiction over the basic craft." James Brownlow, president of the Metal Trades Dept. (AFL-CIO) which opposed a plea by a group of weldors for severance from a boilermakers local, was reported as saying that a bargaining unit based on use of a welding torch "is as ridiculous as trying to base a bargaining unit around those who use the hammer."

Maybe we ought to deluge friend Brownlow with some other opinions . . . to say nothing of showing him the fallacy of his logic.

double take

Tracerlab, Inc., Waltham, Mass., recently received a letter from a manufacturer of roller-bearings, who was interested in using radioactive materials to improve processing.

Many varieties of high-grade steel billets were reduced to rod-stock by passing them through rollers. When the red-hot rods emerged from the rollers it was impossible to distinguish visually one batch from another. This meant waste, so a heat-chaser was utilized to follow the last billet in each batch through the process.

Hoping to improve this method, the firm asked Tracerlab to devise a more efficient method of identifying the end of the batch of metal and start of another. Tracerlab engineers concluded the best method would be to make the heat-chaser radioactive so that it would be immediately detected by Geiger tubes as it emerged from the rollers.

They informed the manufacturer of their proposal . . . asked for additional information such as the size, weight, material, construction, and speed of the heat-chaser to which the radioactive chemicals would be added.

An immediate phone reply from the plant told them that though the firm felt the method would probably work, there might be serious objections. *The heat-chaser was a strapping, good-natured, six-footer wearing asbestos clothing.*

up to the pro ranks

Shots rang and bullets ricocheted recently in Indiana Twp., Pa., when T-men and the local constabulary raided an illegal whiskey operation. The confiscated still —a duplicate in miniature of those used in the distilling industry— was made of heavy gage stainless steel and all copper tubing joints were welded. "It really looked like a professional job," one officer was quoted as saying.

If the officer was referring to the weldments, we wonder to which union our boozing buddy belonged—as well as to which AWS specification he had access when he began his extra-curricular activities.

prize photo

"Molten Lace" is the title of a photograph that won a top award in a recent contest sponsored by the school of journalism at Kent State University, Kent, Ohio. The spectacular photo depicts a shower of sparks coming from a weldor's oxyacetylene torch. The weldor was perched atop the steel framework of a skyscraper under construction. The shot was made by John Duprey, New York *Daily News* staffman.

brazed engine

Our sports car editor (self-appointed) has informed us that the sports car fraternity has discovered a new use for brazing. It appears that one enthusiast has used a brazing to put together a new engine block instead of casting it in one piece. Lightweight—only 180 lbs—the new power plant is said to pound out 180 bhp from approximately 120 cu in.—a real threat to foreign race car supremacy. This is the same design-type as the old Crosley engine but with all bugs taken out.

AEC and cobalt

The Atomic Energy Commission has announced it will discontinue providing gamma ray irradiation service to private industry for detection of flaws in casting, welds, etc . . . on grounds that private cobalt 60 testing facilities in U. S. are now adequate to meet industrial demands—at reasonable prices.

real depression

We see by the *Wall Street Journal* that, following the general business pattern, yacht sales are slow. Ho hum!

quotes from the Bard

A regular reader of ours, E. J. Clark of G-E's Aircraft Accessory Turbine Dept. in Lynn, Mass., has compiled a list of quotations from William Shakespeare which describe common modern-day shop conditions. His first offering is below. We shall continue to publish these quotes with appropriate cartoons on this page from time to time. Look for them.

. . . so tedious is this day

Romeo & Juliet, Act III, Sc 2

Weldynamics

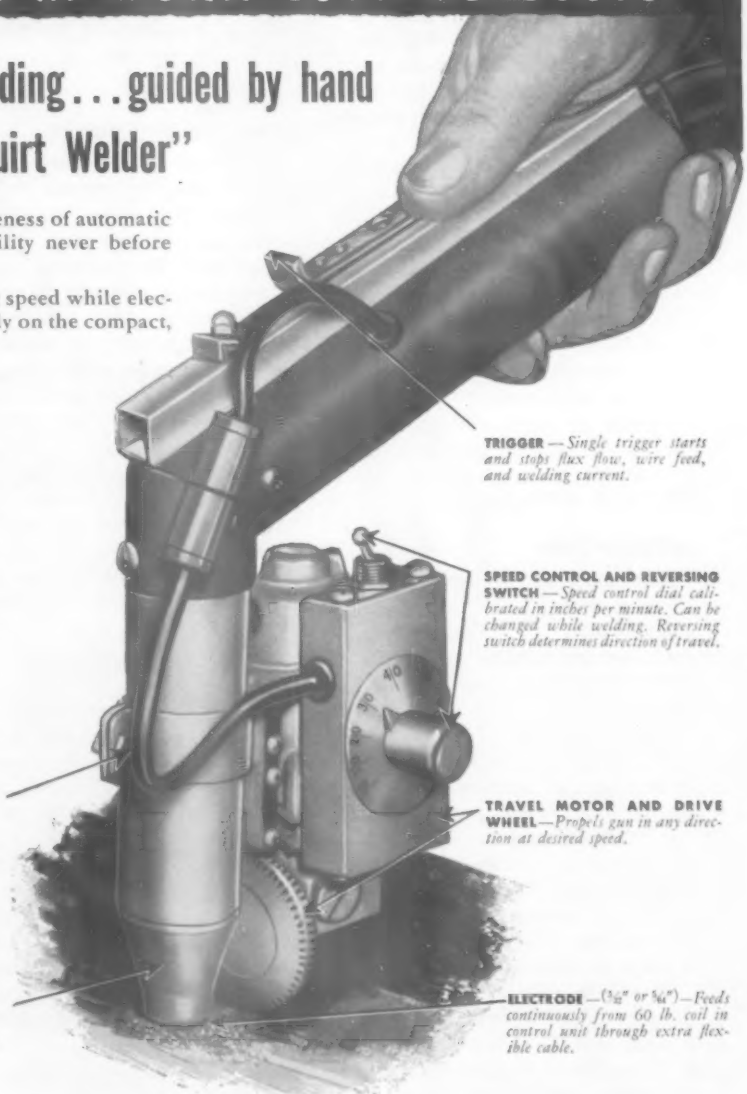
ARC WELDING AT WORK CUTTING COSTS

Completely automatic welding...guided by hand with the "Mechanized Squirt Welder"

Here's how you can get the speed and sureness of automatic welding . . . plus portability and versatility never before heard of in submerged arc welding.

Mechanized gun is propelled at any preset speed while electrode and flux are fed from an all day supply on the compact, portable control unit.

- Accurately controlled speeds from 1 to 70 inches per minute.
- Flux and wire supplies allow many hours of continuous welding.
- Guides in any direction without fixtures.
- Deep penetration of submerged arc welding.
- Easy to make beautiful welds.
- High operator appeal—light gun, no helmet.



TRIGGER—*Single trigger starts and stops flux flow, wire feed, and welding current.*

SPEED CONTROL AND REVERSING SWITCH—*Speed control dial calibrated in inches per minute. Can be changed while welding. Reversing switch determines direction of travel.*

TRAVEL MOTOR AND DRIVE WHEEL—*Propels gun in any direction at desired speed.*

MOTOR MOUNT—*Travel motor easily adjusted up or down to control flux coverage and rotated around the gun to change travel direction. Control wire coupling disconnects for quick removal of entire travel mechanism for manual operation.*

FLUX—*Granular flux feeds through tube from tank on control unit to small reservoir on gun. Flows from gun by gravity as needed.*

ELECTRODE—(5/32" or 3/16")—*Feeds continuously from 60 lb. coil in control unit through extra flexible cable.*

PORTABLE CONTROL UNIT (*not shown*)—*Contains arc voltage and inching speed controls as well as meters for welding current and voltage. Unit also mounts 60 lb. coil of electrode and tank for over 100 lbs. of flux. Entire control system operates on 115 volt AC power.*

The World's Largest Manufacturer of Arc Welding Equipment

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MAY, 1958

Welding Engineer

ESTABLISHED 1916

If it's made of metal—weld it!

THIS HEADLINE duplicates a sign atop the Welding Foundation Building in Morton Grove, Ill. It's a sign that is playing an important role in bringing welding and its broad area of application to the attention of the public.

Of the many thousands of persons who see this sign, at least four, and sometimes as many as eight of them will step into our offices each day to have something welded.

These continuing requests for repair welds, or for welded fabrications, has convinced us that the public—at least in this area—is fairly well sold on welding. But whenever we have put this belief into words, we are immediately asked: "Why isn't more welding being done?"

Perhaps because there aren't enough of us in welding who are genuinely interested in keeping John Q. Public *attuned* to the idea of welding! The all-important man on the street may know that welding is the most logical solution to his metal-joining problems, but it's up to you to see that he doesn't forget.

The job shop in our town, for instance, does a lot more business simply because the sign on our roof makes people *think* about welding as the most natural means for joining metals. We firmly believe that the seed of this knowledge has long since been planted, and that something as simple as this sign can bring it to life.

WE SPOKE LAST MONTH of the manufacturer (of power mowers) who advertised his product as having "no welds to break." Such an ad isn't entirely uncommon, but it's born of ignorance—or of one unfortunate mishap. The negative frame of mind in which it was conceived *could* be converted to a positive viewpoint by the welding enthusiast who steps right up and proves to the doubters that he's talking about something worthwhile.

Such a man, if he took the time to keep valuable facts at his fingertips, might even be the instigator of a future automobile advertisement which tells prospective buyers that a $3,000 four-door sedan is "$10,000 cheaper because of welding." He might, that is, if he *(a)* bothered to discover that this was so, and *(b)* weren't too darned reluctant to proclaim it as a fact.

WHAT BETTER TIME than the present to "tell and sell" the architects, engineers, designers and others who influence the production of industrial America? As a matter of fact, had some responsible welding engineers conceived this urge to "tell and sell" a few months ago, they might have saved New York taxpayers a lot of money in the coming months.

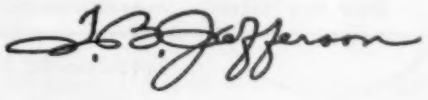
There are plans afoot to add a lower deck to the George Washington bridge. How will the deck be fabricated? By riveting, we're told . . . "and with as little welding as possible."

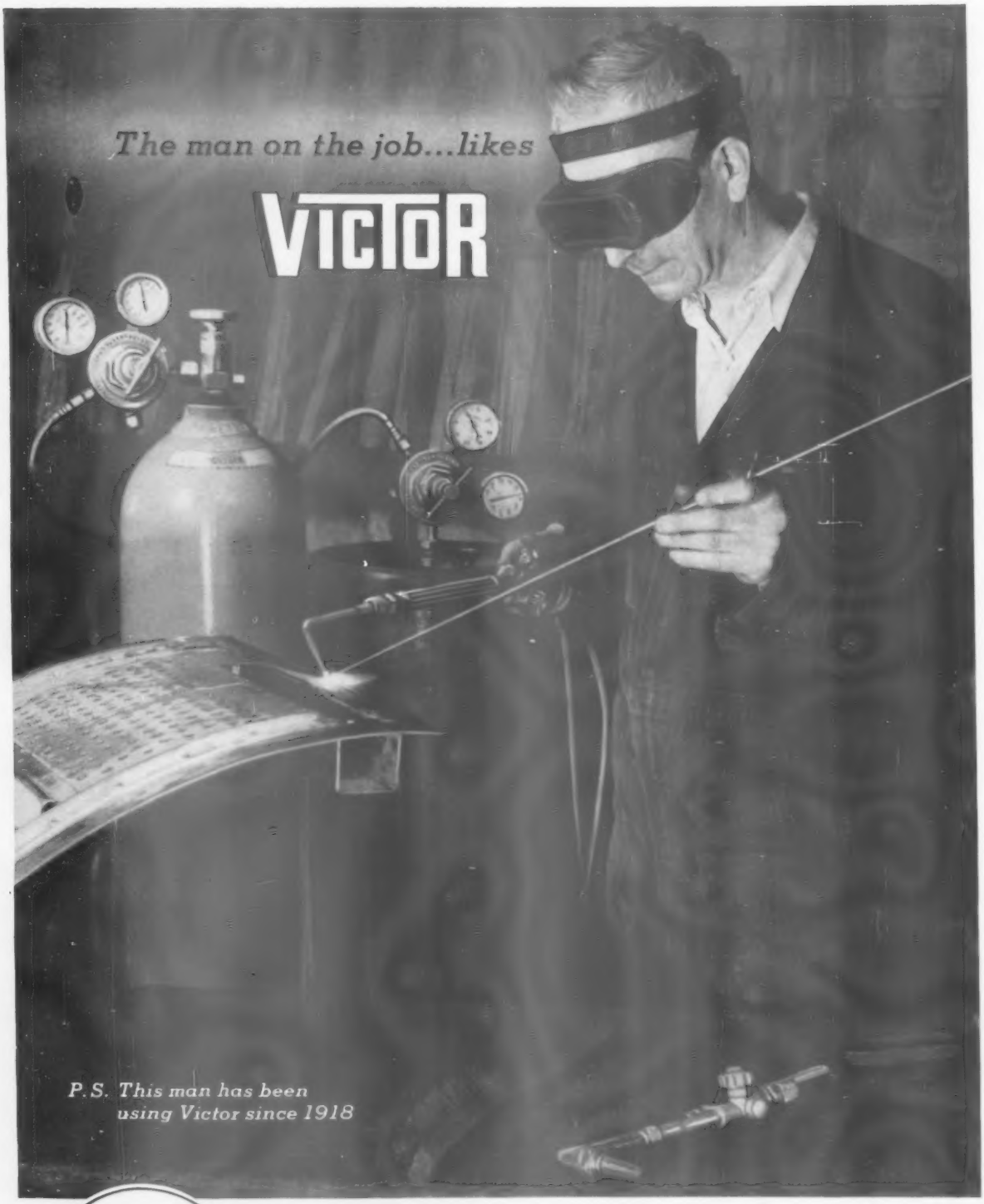
Perhaps the bridge was originally designed for two riveted decks. But so what? Couldn't the engineering and designing hierarchy on this job have been made to realize that welding would definitely save them money?

But even if these men aren't taxpayer-conscious and couldn't be approached on a cost-savings basis, it seems logical to assume that they would want to eliminate the one factor they were trained to avoid: *excess weight*. Surely, capable and responsible engineers aren't going to hang anywhere from 5 to 15% more weight on the cables of this suspension bridge just to avoid the use of welding.

If you're the kind of man that can sell customers on the merits of your products or of your workmanship, then you're also the kind of man that can combat ignorance and keep the thought of welding burning brightly.

We need you—and everyone like you—to get out and sell the idea that, "If it's made of metal —WELD IT."





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VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; High Pressure and Large Volume Gas Regulators; hard-facing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

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ABOVE: Repointed for the 21st time with a manganese-nickel wedge bar is this dipper tooth in use on the Mesabi Range. Subject to erosive conditions that wear it out in a single 8-hour shift, the $27 tooth can be put back into service at a cost of approximately $9. Savings reported on this admittedly unusual repointing job total two-thirds of the cost of 21 new teeth, or $378. Normally, such teeth are repointed four to six times.

BELOW: Use of round applicator bars *(see text)* to armor bottom of dragline bucket. These 3-in. bars are flame-cut to short lengths, tack-welded to bucket leaving ⅛-in. gap, then finish welded with manganese-nickel electrodes which fill gap.

Add some new metal and . . .

Take wasted $$ off the scrap pile

IF THERE'S A SET of cast manganese steel bucket teeth in your scrap pile at the moment, take a close look at them. How much metal has been worn away in digging? Fifteen percent? . . . twenty-five?

If that's all, then you're looking at mighty expensive scrap!

Stulz-Sickles Co., a manufacturer of 11-13½% manganese-nickel steel applicator bars and plates (plus manganese-nickel electrodes and hardfacing types), notes that many progressive firms are currently avoiding such unnecessary expense. How? By rebuilding costly parts as soon as they become worn.

Though the process by which the parts are retrieved for further service cannot truly be called hardfacing (Stulz-Sickles, for instance, terms it "reclamation welding"), results achieved are similar to those obtained through the application, by arc or gas, of a tough surfacing material.

Worn bucket teeth and the buckets themselves . . . crusher and tractor parts . . . chutes and hoppers . . . all are objects for which applicator bars and plates are expressly shaped. And manganese-nickel electrodes are, of course, an ideal type to use in joining new material to the base metal.

One of the photos illustrating this article depicts round applicator bars which, in the case of Stulz-Sickles, are produced in diameters from ⅜ to 3 in., inclusive. A set of 3-in. bars have been used, in this instance, to protect a 17-cu yd carbon steel dragline bucket.

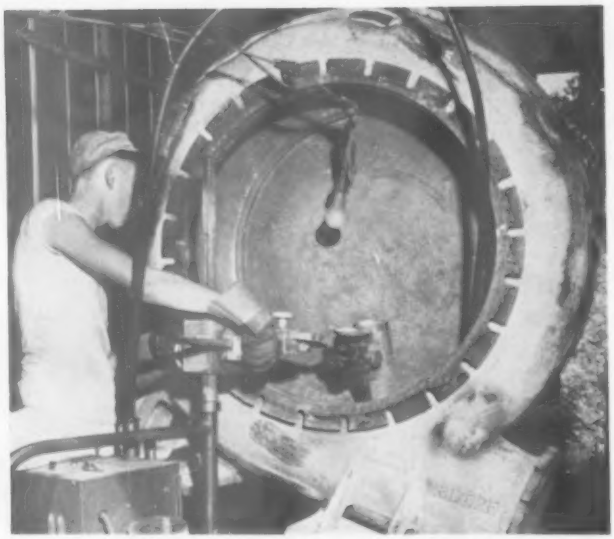
Placement of round bars is preceded by a flame-cutting operation which chops them into short lengths of 8 to 10 in. Cutting is essential; the shorter bars experience only a minimum of shrinkage strain set up during weld cooling, so warpage can be closely controlled.

When the round bar is placed on a bucket (or on crusher jaws, crusher mantles, etc.), a ⅛-in. gap should be left between bar and bucket before tacking. The bar is then welded into place with heavy, weaving passes of a manganese-nickel electrode. These finish welds must meet beneath the bar; no "dead" space can be left.

Stulz-Sickles recommends a skip-welding technique in applying these round bars. No part of the base metal should get so hot that a weldor cannot comfortably hold his bare hand on metal 6 in. from the weld.

Why the ⅛-in. gap? To allow for manganese-nickel steel's high coefficient of expansion and contraction. Why skip-welding? To prevent warpage . . . which could be bad enough to prevent the protected part from performing its job.

It may pay you to glance again at that scrap pile. If you look hard enough, you may begin to see dollar bills.



HARDFACING a manganese steel pump casing with a submerged-arc welder. Mounted on a rotating positioner, the casing moves at welding speeds. Welder is set on especially built, castored carriage which makes it easily moved.

Is automatic hardfacing for you?

By Spencer Payne
Application Engineer
Lincoln Electric Co.

THROUGHOUT THE COUNTRY, from steel mills to construction camps, you can find engineers asking themselves two questions: "Should I hardface?" and "Can I hardface?"

Although it would be impossible to answer each specifically, a good general answer would be: "Yes, you *should* hardface," and "Yes, you *can* hardface."

The principal reason favoring application of hardfacing materials is cost. When parts wear—and can be hardfaced—the process will generally be less expensive than part replacement.

Large steel mill rolls, for example, weigh several tons, but are considered "worn out" if only a few hundred pounds of metal are eroded from journals. Besides the obvious savings of adding the lost material by rebuilding and hardfacing instead of replacing these rolls, there is also the less-obvious economy of minimizing downtime. Extended periods of downtime can be very expensive in terms of lost production and labor.

But hardfacing is helpful for more than just large units—one of the most common hardfacing applications is on tractor rollers. The slight amount of metal abraded from the wheels is actually a fair percentage of total weight. To conserve their rollers and idlers, therefore, many construction firms have bought automatic hardfacing equipment solely for such use.

Furthermore, on process equipment like mixers or crushers, when downtime would idle an entire job, engineers have found that hardfacing adds six to eight times longer life to a unit's workspan.

After-damage-is-done applications are not the only ones on which hardfacing can be put to use. New equipment is very frequently hardfaced before it is sold, and many manufacturers feel the method substantially improves products offered to the public.

Scraper blades, bucket lips and shovel teeth are given outside protection. Ball mill crushers and cyclone-type dust collectors are examples of parts given inner hardfacing. New equipment thus treated can also be reworked once it begins to show wear.

Hardfacing costs depend upon the part being worked. However, as a general rule, the larger the part, the lower the cost per pound of deposited material. This is true because heavier welding currents may be used and higher deposition rates obtained.

To compare the cost of automatic hardfacing with the more familiar manual metal-arc method would indicate that the former technique may cost as little as one-sixth as much as the latter, with comparable wear resistance.

Another factor which must be considered when computing cost per part is volume of work. A manufacturer of new equipment can lower his expenses by using a single-purpose fixture that is tailor-made for the job. Of course, when several jobs must be done on one setup, a more versatile fixture would be needed.

For some shop and field work, a semiautomatic welder is often the answer. These flexible and inexpensive portable welders are ideal when the part to be hardfaced is not removed from the main unit and must be welded while in place.

Their small welding cones are easily inserted in cramped working spaces where other units might not fit.

The entire price question reduces to: "How much is it going to cost *not* to hardface?" and "What are the cost ratios of automatic hardfacing to manual or semiautomatic

THIS entire shop is devoted to rebuilding and hardfacing tractor rollers and idlers. Two setups are used for welding rollers and one for idlers. Both use submerged-arc welding. A positioner rotates shafts at welding speeds. Welding heads are mounted on a carriage riding a box-section beam. Operators make one pass on one roller, move to the next; returning for more passes after first welds have had an opportunity to cool.

methods, including the cost of equipment?"

The first question is easily answered by comparing costs of rebuilding, downtime and replacement with the price of hardfacing. The second question is best referred to an engineering representative of a firm who manufactures the type of equipment you contemplate buying.

A question logically following would be: "Will automatic hardfacing fit the job?" Although the answer is "Yes," the reason for that answer will be more easily understood by a discussion of how the process operates.

Automatic hardfacing uses the heat of an electric arc to melt a consumable mild-steel electrode, an agglomerated hardfacing flux and base metal into a common, molten pool.

As the arc travels over the work, this pool solidifies, and forms an alloy deposit that fuses to the work. What this alloy deposit contains depends primarily on welding materials used, type of base metal, and the way welds were made.

While hardfacing is being done, the arc is completely hidden, covered by flux. Arc voltage (arc length), welding current and travel speed are all automatically controlled once they are set.

Automatic welding produces a large, molten pool much like that of fast-fill, iron-powder manual electrodes. Consequently, it solidifies slowly, and must be on a horizontal plane to prevent spilling or running.

This imposes a limitation on automatic hardfacing—it must be done on work placed in the flat position or on work which can be rotated under the welding head.

Pieces as small as 3 in. in diameter can be hardfaced by submerged-arc. But flat work is gaged only by part thickness sufficient to prevent arc burn-through. When constructing a fixure or automatic setup, proper work position is therefore one of the first considerations of automatic hardfacing.

Another consideration is deposit properties. There are four types of agglomerated flux that can be used with either mild-steel or medium-carbon electrodes. With these four, deposits can range from those that are machinable to highly abrasion-resistant chrome carbides for units like coal crushers.

Any specific combination of flux and electrode will produce a range of properties which can be controlled by selecting the proper welding procedure for that combination.

A proper welding procedure determines alloy content and the deposit's cooling rate. Alloy content is most affected by the amount of alloy picked up from the hardfacing flux, and the amount of dilution caused by mixture with base metal. A correct welding procedure will increase alloy pickup and will minimize dilution.

IN-the-field welding on the roll of a portable crusher. Welder is submerged-arc; deposit is chrome carbide. Life of the roller will be substantially increased by hardfacing.

Cooling rate is equally important, because alloy properties vary with heat treatment. Automatic submerged-arc hardfacing controls the cooling rate which, in turn, governs the heat treatment.

Although these recommendations are for average hardfacing, individual job considerations will influence a decision for—or against—use of automatic hardfacing.

We can conclude, however, that *if* the job meets the above requirements —and *if* it is more expensive *not* to hardface—then automatic hardfacing will probably produce substantial savings.

Developing a molecular bond

STEP 1—Grit blasting, preferred method of surface preparation prior to hardfacing by spray technique, is being completed on this shaft. Author states that rough threading should be used for surface preparation only where grit blasting is not available.

STEP 2—Application of hardfacing powder to shaft utilizes, in this instance, two pistols for speedier operation. By mounting cylindrical objects in lathe, and pistol in tool post, lathe's traversing mechanism can be used to obtain a more constant pistol speed and a more uniform deposit.

STEP 3—Fusion of sprayed overlay is best accomplished with an oxyacetylene torch, using either single or multi-orifice tip. Use of controlled-atmosphere furnace for overlay fusion requires great skill, so torch is preferred method.

Spray and fuse... a popular hardfacing method

By **H. S. Gonser,** *Vice President*
Wall Colmonoy Corp.

THE SPRAY TECHNIQUE for hardfacing is *not* synonymous with that for metallizing.

Hardfacing entails the development of a molecular bond between base metal and the protective overlay. In other words, a true welding action must exist to qualify a given application as one of hardfacing.

(Wall Colmonoy's own spray and fuse technique is known as the "Sprayweld Process".)

All spray applications of drawn wire are of the metallizing type. More than 90% are not hardfacing. Instead, they are used for rebuilding worn surfaces to original size, and for corrosion-resistant surface coatings.

Martensitic type (400 series) stainless steel wires or high-carbon steel wires will give a fairly hard surface. They cannot be called true hardfacing materials, however, because the bond between overlay and base metal is only mechanical. Any form of high-stress abrasion may tear off an overlay bonded in such a manner.

Molybdenum wire is a partial exception to the rule: it is a sprayed material whose metallized bond is partially molecular. This occurs as a result of the extremely high temperature [*approx. 4,760 F* — Ed.] required to melt molybdenum. During spraying, the molybdenum particles are sufficiently hot to partially fuse upon contact with base metal.

True hardfacing requires a true molecular bond—achieved only by thoroughly fusing the overlay. Applicable materials—those capable of being sprayed and fused—are not malleable, so they cannot be drawn into wire form.

Hardfacing materials for spray application are available in powder form only. The powder, however, may be used to impregnate plastic drawn into wire form. This may then be used with wire-type spray equipment for hardfacing applications.

The plastic must vaporize completely in the spray flame without affecting the hardfacing powder in any way. *It must not deposit on the work.* Further, the plastic must be flexible enough to avoid feeding problems, and strong enough to resist breakage when it is unreeled from a coil.

The wire technique, generally, is similar to that used in powder-spray applications. Recommendations presented in this article for powder-spray hardfacing may be considered (*for most applications*) a satisfactory guide to wire techniques as well.

Surface preparation is the first step taken before hardfacing any material with the spray technique. Areas

to be overlaid must first be undercut an amount equal to the finished overlay thickness desired.

A minimum recommendation for thickness of the finished overlay is 0.005 in. per side, plus wear tolerance. For example, if a given shaft or sleeve can be allowed to wear 0.020 in. on diameter before reclamation or replacement is required, finished overlay thickness should be 0.015 in. per side—a 0.030-in. buildup on diameter.

A surface to be overlaid must have all plating or other surface treatment (*e.g.*, nitriding or carburizing) removed. The undercut surface should then be either grit blasted or rough threaded.

Grit blasting is preferred always; rough threading is acceptable only where grit blasting equipment is not available. Where rough threading must be used, overlays greater than 0.025 in. are generally required to insure adequate surface protection after machining.

Grit blasting gives a rougher, more uniform surface. Roughness enhances the mechanical bond during spraying, and surface uniformity permits greater economy in the application of thin overlays of hardfacing material.

Crushed chilled-iron grit (*not shot*) is recommended for grit blasting prior to spray hardfacing. Normal blasting should be performed at pressures of 90 to 100 psi.

Where surface hardness of base metal is under 35 Rockwell C, the part may be undercut and grit blasted without prior treatment. For surface hardness greater than 35 R_c, the part should be annealed (and straightened, if necessary) prior to undercutting and grit blasting.

Grit size required for proper roughing of a surface is dependent on these factors:

1—Overlay thickness.

2—Thickness of workpiece section.

3—Surface hardness of workpiece.

Where a hardfacing overlay is to be light (up to 0.015 in. thick); where workpiece section is thin (⅛ in. thick or less), or where surface hardness is below 20 Rockwell C, SAE 25 mesh grit should be used. Where none of the foregoing conditions exist, SAE 14 to 18 mesh grit should be used.

When blasting sections ⅛ in. thick or less, blasting pressure should be reduced to prevent possible warpage. Recommended pressure is 50 to 60 psi.

Extreme care should be taken to keep the surface absolutely free of dirt, grease, oxidation and hand prints after grit blasting. A spot of oil can ruin an otherwise good job.

There is a maximum, as well as minimum, overlay thickness. And a good general rule concerning it is this: *do not exceed a 0.060-in. buildup in spray hardfacing.* (This refers to overlay thickness after fusing.)

Allowances that must be made for fusion shrinkage increase the allowable "as-sprayed" overlay thickness. For the most commonly used hardfacing powders, this shrinkage is about 20%—so as-sprayed thickness can be about 0.070 to 0.75 in. Since base metal becomes heated during spraying, allowances for thermal expansion should also be made when measuring as-sprayed thickness prior to the fusing operation.

In many cases where required overlay thickness must exceed 0.060 in., application with an oxyacetylene torch and hardfacing rod may be more economical. This is generally the case with parts having flat or irregular surfaces. Cylindrical parts, however, are more economically hardfaced with the spray technique for almost any buildup.

Actual thickness of the sprayed overlay (as measured before fusing) is determined by adding: (*1*) depth of undercut; (*2*) amount to be removed in finishing (*3*) calculated shrinkage of sprayed overlay, and (*4*) calculated shrinkage of base metal.

The spray pistol should generally be held with the flame about 1 in. from the work (*i.e.*, about 7 in. from work to pistol tip). Optimum distance from the work will vary with flame heat, size of workpiece and workpiece section thickness.

Thin sections, for example, will heat up too fast—causing oxidation and poor bonding—if the spray flame is not backed-off to some extent. So-called "hotter" spray flames (those producing more Btu's) should also be held somewhat farther away for the same reason.

Small-diameter solid sections, on the other hand, can be sprayed with the pistol held closer to take advantage of the narrow portion of the spray pattern for minimum overspray and maximum economy. The pistol should be traversed to produce a uniform overlay.

Cylindrical parts are best mounted in a lathe or turning fixture. Where a lathe is used, the pistol can be held in the tool post and the lathe's traversing mechanism utilized for constant-speed movement of the pistol.

As overlay uniformity increases, time required for finishing decreases. Pistol traverse action across flat surfaces should be made at a rate which deposits 0.010 to 0.015 in. of material per pass.

Fusing a sprayed overlay can be done in either of two ways: (*1*) with an oxyacetylene torch, or (*2*) in a controlled-atmosphere furnace. Preferred and most commonly used method is fusing with the torch.

Either a single or multi-orifice torch tip is used, and its size is dependent on size of the work. The flame is played on base metal adjacent to the overlay until it reaches a dull red heat, then is moved to the overlay.

As the overlay assumes a glassy appearance, the torch is moved on across the overlaid area until all the material is fused. Torch movement should be maintained at a constant rate, just fast enough to avoid overheating.

Furnace fusing of sprayed hardfacing overlays, because it requires the use of costly equipment, is usually given to an outside service by those firms who want to employ this method. It is a difficult method requiring substantial skill and experience for proper execution.

When material thickness must exceed 0.060 in. per side, buildup should be done in successive applications, each having a net overlay thickness no greater than 0.060 in. Technique and procedure are best explained by using this typical example:

Example—a conveyor shaft 2 in. in diameter in which a groove 0.105 in. deep has been worn. Wear tolerance for this part has been established at 0.200 in. on diameter, so the part is ready for reclamation by hardfacing. Total buildup per side is determined by adding the following:

Depth of undercut (per side).....0.110 in.

Finishing stock (per side)	0.015 in.
Hardfacing material shrinkage (20% of above)	0.025 in.
Base metal shrinkage (assumed for example purposes, but would be calculated in actual practice)	0.020 in.
Total buildup (per side)	0.170 in.

Since the limit per application is 0.060 in. (0.075 in. measured as-sprayed), it is necessary to obtain a buildup of 0.170 in. in three applications. After cleaning, undercutting and grit blasting, the first layer of 0.075 in. is sprayed and fused in the manner previously described. The fused overlay is then allowed to cool in air to approximately room temperature.

A surface film of boric oxide will develop during spraying and fusing. To insure proper molecular (*fused*) bond between successive layers, it is essential that this film be removed either by conventional wire-brush technique or by vigorous scrubbing with a brittle brush and hot water.

After cleaning, the part is re-positioned for spraying. The previously applied overlay is then heated with an oxyacetylene torch to approximately 1,500 F and the next buildup of 0.075 in. (making 0.150 in. total) is sprayed onto the hot surface and fused in the usual manner.

Cleaning, re-positioning, heating, spraying and fusing are then repeated for the final overlay to bring total buildup to 0.170 in. when measured as-sprayed. The reason for heating the previous overlay—instead of grit blasting—is that surface hardness is far too high by that time to expect grit to be effective.

Sprayed and fused overlays of hardfacing materials can be machined, as a general rule, with "Carboloy 883," "Firthite H.A." or similar carbide tools. The tool should have slight lead and rake angles.

For roughing, a fine feed should be used. Depth of cut should be 0.010 to 0.015 in. maximum. Workpiece rotation should be 35 surface ft per minute.

If the overlay shows a tendency to chip at various speeds, feed or depth-of-cut settings, each should be reduced accordingly. Best results are obtained if the tool is provided with a small radius (approximately 1/32 in.).

Although a machined finish is sometimes acceptable, it is recommended that the final finish be obtained by grinding. Specific wheel recommendations for nickel-base alloys, tabulated from data supplied by leading grinding wheel manufacturers, will be presented in Data Sheet No. 213 in the June issue of WELDING ENGINEER. (Nickel-base alloys are the most commonly used hardfacing materials for spray application.)

Wet grinding of these alloys should be done whenever possible. Due to the abrasion-resistant qualities of hardfacing materials, considerable pressure is required to remove stock. This results in high surface temperatures which may produce surface checks.

In general, economical grinding of nickel-base hardfacing alloys can best be done by taking light, fast cuts. Use a roughly-dressed wheel for roughing and a medium-dressed wheel for finishing.

Spray gun capacity is a characteristic used to indicate the capabilities of various types of spray equipment. It has a definite bearing on technique but, unfortunately, is generally misunderstood.

MOLD used by glass industry is spray-hardfaced to resist conditions of high heat and severe abrasion.

Spray gun capacity is usually expressed in terms of so many pounds per hour. This is misleading because of the multitude of factors that enter into such a determination, which must be expressed to positively qualify capacity.

Specific gravity of the material, for example, is an important factor. A heavy powder can be sprayed at a greater rate than a light powder, all other things being equal. Also, a powder with low melting point can be sprayed more rapidly than one with a higher melting point.

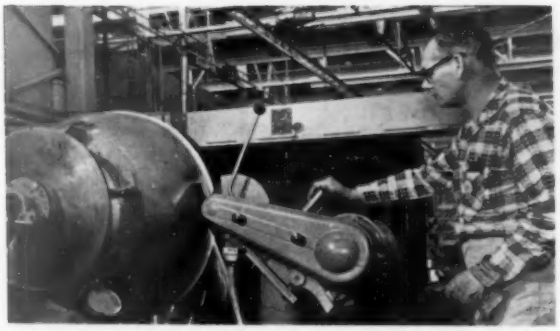
The effect of spraying rate on deposit efficiency is, perhaps, of even greater significance. Deposit efficiency is a direct measure of economy in spray-type hardfacing applications. It is the ratio of powder sprayed to powder deposited on the work.

Most spray equipment operates in the feed-rate range of 5 to 10 lb per hour using nickel-base alloys (powders with a specific gravity of approximately 8). This is an optimum range for efficiency. Operating rate *could* be as low as 2 or 3 lb/hr, or as high as 14 or 15 lb/hr.

At feed rates below 5 lb/hr, the powder has a tendency to overheat and oxidize before reaching the work. The result is that it bounces off the work, giving poor deposit efficiency. At feed rates above 10 lb/hr, the material does not spend sufficient time in the flame to become plastic enough for good adherence.

Major factors affecting deposit efficiency are these:

1—Feed rate.
2—Alloy melting point.
3—Flame heat.
4—Powder velocity *through* flame, and time *in* flame.
5—Screen analysis of powder *(finer powder heats faster)*.
6—Specific gravity of alloy.
7—Shape of work.
8—Overspray and bounce.
9—Surface preparation *(degree of roughness)*.
10—Gun position *(distance from work)*.



GRINDING a seam-welded, spherical fuel tank. Welding and brazing played prime roles in fabrication of hypersonic plane.

WELDOR works on connection for fuel tank system. X-15 is primarily stainless steel to combat high-temperature conditions.

TEST pilot Scott Crossfield with X-15 blueprints. Behind him is veiled model of new craft. Note welding equipment in background.

Rocket plane depends on welding

HALF PLANE, HALF MISSILE, the X-15 rocket plane developed by North American Aviation, Inc., could be made, without extensive modifications, into a recoverable, manned satellite.

Radically designed, the X-15 will be capable of speeds above 3,600 miles per hour—better than a mile a second. It will carry man to altitudes over 100 miles above the earth and return him safely through the atmosphere to the ground.

Basically experimental and designed for research purposes, the X-15 is being built for the Air Force, Navy and NACA (National Advisory Committee on Aeronautics) and will probably be test-flown sometime in 1959.

The heat problem as the plane reenters the earth's atmosphere is of primary concern to designers and engineers planning the craft. Skin temperatures will reach approximately 1,000 F and the X-15 will glow as red as a blacksmith's forge as it cuts the line between no-atmosphere and atmosphere.

The heat will be as intense as a room filled with 80 home furnaces going full blast but, fortunately, for only a very brief time.

Learning of the X-15's construction, the Committee of Stainless Steel Producers of the AISI pointed out that this metal has a high strength/weight ratio . . . maintains aerodynamic properties in high temperatures . . . is rigid under fatigue conditions encountered in hypersonic flight . . . and is ideal for this work.

Over 3,245 hours of testing will be lavished on the craft in wind tunnels and with temperatures requiring 870,000 watts (equivalent to 8,700 100-watt light bulbs).

Fabrication methods, too, approach missile techniques, and that means welding. About 65% of the X-15 will be welded or brazed.

For instance, tube and thread fasteners are being eliminated on hydraulic tubes by the use of brazing. Engineers are thereby assured of leak-proof joints.

Brazing is done inside the ship during assembly. A metal sleeve is placed over the tube ends and a special induction heating coil is wrapped on the sleeve and tube ends to melt brazing alloy and so form a gas-tight joint.

Throughout the plane, both automatic fusion welding and resistance welding techniques are used because this multi-mission craft must be stronger than a one-shot missile.

Although the X-15 is literally kept under wraps for security reasons, it is known that the ship will be pencil-thin with cleaver-blade wings.

Here's how—whenever plowshares must be hardfaced

OF ALL THE farm equipment tasks that welding job shop owners must face, plowshares certainly constitute a heavy percentage. And most of these shares are brought in, not for the repair of a break, but for welded repointing and hardfacing.

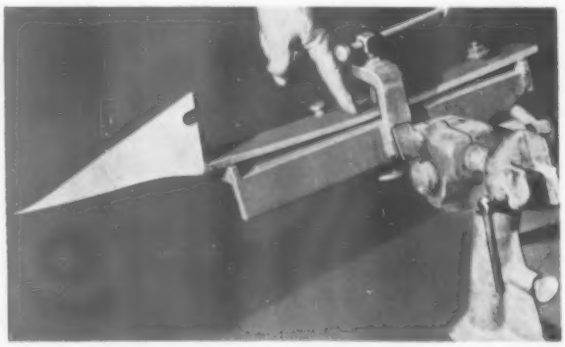
There are many materials used for these life-lengthening applications: among them, two products manufactured by Stoody Co., Whittier, Calif. Termed "Stoodite" and "Borod", they are respectively, a chromium-manganese-zirconium-carbon-iron alloy, and a steel tube which contains tungsten carbide particles.

The weldor in the photos on these pages is using "Borod" and "Tube Stoodite" (which is made exclusively for oxyacetylene application). But whether you use these particular hardfacing materials or not, the procedures outlined by Stoody for its customers will undoubtedly help you to turn out plowshare jobs faster, and with less expense.

1
Place share nose-first in fire and heat to about 1725 F *(orange color)*. When heated, place nose under power hammer and draw out until it is 1/8 in. thick at the point and 1 1/8 in. thick four inches back from point.

2
Place share on anvil and lower point for proper suction, then put quarterbar over the heel of the anvil and forge the point down until it's straight. Re-heat edge of share to 1725 F and draw it out 7/16 in. over its entire length. Properly sharpened, share is 1/16 in. thick at edge, tapering to 1/8 in. at point 1 1/4 in. back from edge. Lastly, lower heel for proper suction.

3
Grind underside of share approximately 1 1/2 in. upward from edge, and grind quarterbar 3 in. upward from the point. The top side of the nose should be ground about 4 1/2 in. upward from the point, then grind the nose square to receive a cast plow-point bar. Point thickness should be 3/32 in. for a 3/16 in. bar; 5/32 in. for a 1/4 in. bar. Bevel edge to assure penetration.

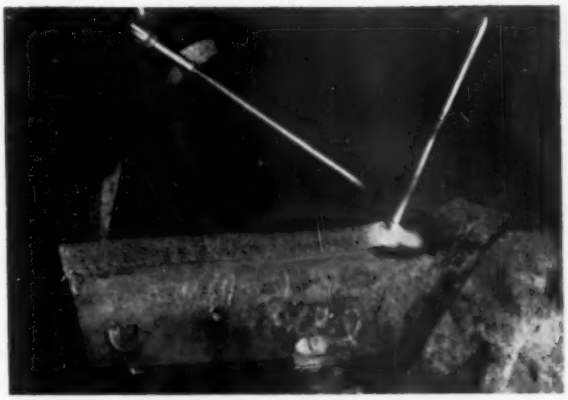


4
Pre-bending the share in the jig which will hold it for welding can help reduce warpage which may occur as a result of welding.

(**Note:** Soft-center shares have dead-soft quarterbars. By applying a work-hardening alloy (e. g.: chromium-manganese-carbon-iron) to the back of a worn point before it is heated and drawn out, the weldor can retain the hard outer shell).

5

With the share in the jig, underside up, the weldor selects a tip with an orifice of 46 to 50 drill size (necessary, in this instance, for the "Tube Stoodite"). Using a flame that has a feather three times the length of the inner cone, and with a 3/16-in.-diameter rod, he begins deposition at the heel of the share and works toward the nose. Deposit along edge should be 1¼ in. wide.



6

Turning point up, weldor tacks plow-point bar to extreme point, cuts it to proper length with torch, then tacks cut-off end. (This bar is valuable only if plowshare is *not* to be used in rocky soil. Sharply abrasive soil requires the application of tungsten carbide particles in a fairly thin and narrow deposit. Do *not* use such a deposit on the top side of the point).

7

Turning the share top side up, weldor completes V-butt weld to blend in plow-point bar with 3/16 in. rod. This deposit should run out 4 in. upward on ground area of the point.

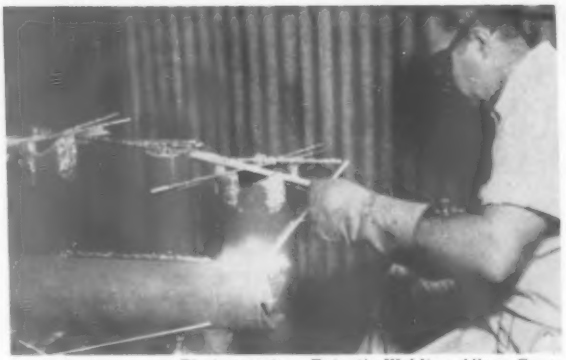
8

With quarterbar up, rod is deposited 2½ in. upward from point. A layer of tungsten carbide particles is then deposited just back of the plow-point bar; it should vary in width from approximately ½ in. on the upper edge of the share to about 1 in. at the bottom. The point can now be dressed-up as needed, and sharpened by beveling the top side 3/16 in. back from edge.

HARDFACING FILLER METALS are available in a wide variety of forms, including bare rods, coated electrodes (with or without iron powder), hollow carbide-filled tubes and powders for metal spraying.

Bare rods may be used with oxy-acetylene, manual metal-arc, submerged-arc or one of the inert-gas-shielded arc welding processes (Mig or Tig). Conventional coated electrodes are now being supplemented by iron-powder types.

Hollow tubes filled with tungsten carbide or other alloying ingredients provide filler metals for both automatic and manual welding. Lastly, hardfacing powder combinations are applied by metal spraying followed by a fusion treatment.



OIL drilling tools are hardfaced with a unique composite rod whose tough tungsten-carbide deposits prolong service life and increase cutting efficiency.

Photo courtesy Eutectic Welding Alloys Corp.

Filler metals for joining

By Orville T. Barnett*

The American Welding Society has prepared a specification for hardfacing rods and electrodes (AWS A 5.13-56T and ASTM A 399-56T), but specifications are hindered by lack of standardization for these products.

Much of the difficulty stems from unreliable performance tests. The AWS-ASTM specifications apply only to alloys which: *(1)* have achieved approximate industrial standardization; *(2)* either were not patented or the patents had expired; and *(3)* were marketed by more than one manufacturer.

A further complication is in designating areas to be covered by the specification. One approach is found in the table where hardfacing alloys are listed and given ratings in terms of six useful attributes.

Hardfacing is an expensive operation from a standpoint of material and labor costs. But considered from the viewpoint of extended service life for high-cost construction tools and machines by a relatively small application of hardfacing in the right places, it is a great boon.

When equipment destined for the scrap pile is restored to useful service, a few pounds of costly filler metal and a few man-hours of high-priced labor appear insignificant.

Although many factors regulate correct choice of surfacing filler metals, primary performance characteristics to be considered are: hardness; hot-hardness; impact, oxidation, corrosion and abrasion resistance; metal-to-metal wear; resistance to deformation at ambient or elevated temperatures; welding characteristics; machinability; heat treatment, and compatibility with base metal.

When either salesman, engineer or user has combined keen observation, knowledge of material characteristics, and insight about service conditions, then—and only then—can best selection of a particular alloy be made. Lack of such an approach can result in misapplications which may persist for years.

A background of experience is also valuable when it covers a clearly defined area over a long period and includes considerable experimentation. Examples of this are use of chromium irons on wheat-belt plowshares and tungsten carbide composites on oil-well rock drill bits.

Present in the table, but not well standardized or covered by specifications, are the hardenable low-alloy steels frequently rendered air-hardening by carbon (C), chromium (Cr), molybdenum (Mo) and tungsten (W).

Usually, these materials in grades just above the IA5 high-speed steels have excellent toughness and impact resistance, as well as adequate wear resistance for light wear conditions. They are often used for buildup—followed by final surfacing with a more costly alloy. Found in this group are new iron-powder electrodes with low-hydrogen coatings which save from 10 to 40% of actual welding cost where the manual arc method is commonly used.

Another advantage offered by these low-alloy types is better compatibility with higher carbon base metals, which might suffer from underbead cracking with other coating types. Many of these electrodes use steel core wires with alloy ingredients in the coating.

High-speed steels are another ferrous alloy group. Three grades are listed, with Fe5-A and -B reported as best for cutting and machining applications because of higher carbon. The Fe5-C type is considered best for hot-working and toughness. Typical surfacing applications include cutting tools, shear blades, forming and shearing dies, rolling mill guides and ingot tongs.

Some outstanding properties of these high-speed steels are: *(1)* hot-hardness up to 1,100 F, where the Rockwell C hardness falls from 60 to about 47; *(2)* deposits which can be annealed for machining; *(3)* good tempered impact resistance and an as-deposited filler metal that will withstand moderate impact without cracking; *(4)* oxidation and corrosion resistance comparable to carbon steels, and *(5)* good metal-to-metal wear at elevated temperatures.

Hadfield manganese steel (10 to 14% Mn), an austenitic ferrous-base alloy, is found in two types, EFeMn-A (nickel-manganese) or EFeMn-B (molybdenum-manganese)

*Assistant manager, Metals Research Dept., Armour Research Foundation of Illinois Institute of Technology, Chicago.

either bare or coated. Some users believe type B to be superior to type A deposits in track work because of higher yield strength, but generally, both are used interchangeably in most applications.

These deposits work-harden from an as-deposited value of 170-230 BHN to 450-550 BHN (Brinell hardness number) in service, proving hardness measurements alone are no criteria of anticipated wear resistance.

Points of metal-to-metal wear—as in railroad frogs and crossings—provide a well-known application for this filler metal. All kinds of rock can be crushed by manganese steel, and filler bars are frequently welded in place with EFeMn electrodes where large sections of shovel parts are replaced.

Bare wire applications with manual arc welding are often faster than depositing metal from coated electrodes. Bare wire for semiautomatic and automatic welding is also available, as well as steel tubes filled with alloying and fluxing ingredients to produce the austenitic manganese analysis by automatic arc welding. Since heat treating response is somewhat ticklish, study of this factor is suggested before proceeding with any job.

Both FeCr-A rods and electrodes are used for similar services despite analysis differences between FeCr-A1 and -A2 types. These filler metals are popular in surfacing agricultural machinery parts. Electrodes, both coated-manual and tubular-automatic types, are employed in arc welding heavy sections. Thin sections, such as found in plowshares, are deposited by oxyacetylene welding.

Although sandy-soil erosion and low-stress scratch abrasion have little effect, these alloys cannot handle the impact problems of rocky soil. Industrial applications include coke chutes, steel mill guides, sand blasting equipment and brick-making machinery among others.

Hardness in these materials is a guide to micro-structure but, again, has limited relationship to wear qualities. Hot-hardness is satisfactory to about 800 to 900 F. Oxidation resistance is good up to 1,800 F, providing the associated hot plasticity can be tolerated.

Since chromium is predominantly in the form of chromium-carbides, the chromium-lean matrix is not particularly corrosion resistant, nor is metal-to-metal wear very satisfactory, except in rolling mill guides. Machinability is poor and grinding is difficult. Heat treatment produces little change in properties.

Comparative ratings (10-100) of hardfacing alloys

	Hardness	Atmospheric corrosion resistance	Resistance to earth abrasion	Resistance to hot deformation	Heavy abrasion service	Sliding & rolling service wear
I. Ferrous						
A. Hardenable alloys						
1. Carbon steels						
a. low	10	10	10	10	10	20
b. medium	10/40	10	10	10	10	50
c. high	20/60	10	20	10	10	50
2. Low-alloy steels						
a. low carbon	10	10	10	10	10	30
b. medium carbon	20/40	10	10	10	20	50
c. high carbon	20/60	10	20	20	20	50
d. cast-iron types	20/60	10	40	20	20	40
3. Medium-alloy steels						
a. medium carbon	20/40	20	20	30	50	60
b. high carbon	30/50	20	40	50	80	60
c. cast-iron types	30/70	20	50	60	50	40
4. Medium-high alloy						
a. low carbon	20/40	20/50	20	40	30	40
b. medium carbon	30/60	20/30	40	50	70	60
c. high carbon	40/80	20/30	60	50	80	40
d. cast-iron types	40/80	20/30	70	50	50	40
5. High-speed steel	80	20	40	70	40	40
B. Austenitic steels						
1. Chromium and Cr-Ni						
a. low carbon	30	90/100	20	20	30	30
b. high carbon, low nickel	40	90/100	20	40	50	30
c. high carbon, high nickel	40	90/100	30	40	50	30
2. High manganese	40	50	20	20	80	50
C. Austenitic-not usually heat treated						
1. High-chromium iron	60	60/80	70	80	80	80
2. High-alloy iron						
a. 1.7% carbon	70	60/80	60	60	70	70
b. 2.5% carbon	70	60/80	70	60	60	80/90
c. very high alloy	80	60/80	80	60	50	90/100
II. Cobalt-base alloys						
A. Low alloy	40	90/100	50	100	80	90/100
B. High alloy	70	90/100	70	100	60	100
III. Carbides						
A. Inserts	100	60/80	100	100	50	100
B. Composite	75/100	30/60	100	—	70	—
C. Powder	—	—	100	—	70	—
IV. Copper-base						
A. Copper-zinc	20	60/80	20	10	10	80/100
B. Copper-silicon	25	60/80	20	10	10	50/70
C. Copper-aluminum	25/40	60/80	30	10	10	70/90
V. Nickel-base						
A. Nickel-copper	20	80/100	20	10	20	20
B. Nickel-chromium	30	80/100	40	70	40	60
C. Nickel-chrome-tungsten-moly	50	90/100	50	90	60	80

Cobalt-base alloys are considered best for valve parts and other applications requiring corrosion and erosion resistance, as well as good hot-

Chemical requirements for hardfacing electrodes, rods

AWS-ASTM Classification	Carbon, per cent	Manganese, per cent	Cobalt, per cent	Tungsten, per cent	Nickel, per cent	Chromium, per cent	Molybdenum, per cent	Iron, per cent	Vanadium, per cent	Copper, per cent	Aluminum, per cent	Zinc per cent	Silicon, per cent	Lead, per cent	Tin, per cent	Phosphorus, per cent	Total Other Elements, per cent[b]
EFe5-A	0.7 to 1.0	0.50	...	5.0 to 7.0	...	3.0 to 5.0	4.0 to 6.0	remainder	1.0 to 2.5	...	...	...	0.70	...	...	...	1.0
EFe5-B	0.5 to 0.9	0.50	...	1.0 to 2.5	...	3.0 to 5.0	5.0 to 9.5	remainder	0.8 to 1.3	...	...	...	0.70	...	...	...	1.0
EFe5-C	0.3 to 0.5	0.50	...	1.0 to 2.5	...	3.0 to 5.0	5.0 to 9.0	remainder	0.8 to 1.2	...	...	...	0.70	...	...	...	1.0
EFeMn-A bare	0.55 to 0.90	12.5 to 16.0	...	...	2.75 to 5.0	0.50	...	remainder	...	...	...	...	0.4 to 1.3	...	...	0.07	1.0
EFeMn-A covered	0.5 to 0.9	11.0 to 16.0	...	...	2.75 min	0.50	...	remainder	...	...	...	...	0.3 to 1.3	...	...	0.07	1.0
EFeMn-B bare	0.65 to 0.90	12.5 to 16.0	...	...	...	0.50	0.6 to 1.4	remainder	...	...	...	...	0.4 to 1.3	...	...	0.07	1.0
EFeMn-B covered	0.5 to 0.9	11.0 to 16.0	...	...	...	0.50	0.6 to 1.4	remainder	...	...	...	...	0.3 to 1.3	...	...	0.07	1.0
EFeCr-A1	3.0 to 5.0	4.0 to 8.0	...	...	...	26.0 to 32.0	...	remainder	...	...	...	...	1.0 to 2.5	...	...	...	1.0
EFeCr-A2	3.0 to 5.0	1.0	...	...	2.5 to 4.5	26.0 to 32.0	...	remainder	...	...	...	...	0.5 to 2.0	...	...	...	1.0
ECoCr-A	0.7 to 1.4	2.0	remainder	3.0 to 6.0	3.0	25.0 to 32.0	1.0	5.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
ECoCr-B	1.0 to 1.7	2.0	remainder	7.0 to 9.5	3.0	25.0 to 32.0	1.0	5.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
ECoCr-C	1.75 to 3.0	2.0	remainder	11.0 to 14.0	3.0	25.0 to 33.0	1.0	5.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
ECuZn-E[c]	...	0.30	...	...	...	...	...	1.50	...	56.0 min	0.01[b]	remainder	0.04 to 0.25	0.05[b]	2.0 to 3.0	...	0.50
ECuSi[d, e]	...	1.5[f]	...	...	[b]	...	...	0.5	...	remainder	0.01[b]	[b]	2.8 to 4.0	0.02[b]	1.5[f]	[b]	0.50
ECuAl-A2[d, e]	...	...	...	...	...	...	...	1.5	...	remainder	9.0 to 11.0	0.02	0.10	0.02	...	...	0.50
ECuAl-B[d, e]	...	...	...	...	...	...	...	3.0 to 4.25	...	remainder	11.0 to 12.0	0.02	0.10	0.02	...	...	0.50
ECuAl-C[d]	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	12.0 to 13.0	0.02	0.04	0.02	...	...	0.50
ECuAl-D	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	13.0 to 14.0	0.02	0.04	0.02	...	...	0.50
ECuAl-E	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	14.0 to 15.0	0.02	0.04	0.02	...	...	0.50
ECuSn-A[d, e]	...	[b]	...	...	[b]	...	...	[b]	...	remainder	0.01[b]	[b]	[b]	0.02[b]	4.8 to 5.8	0.15 to 0.35	0.50

[a] *Analyses given are electrode analyses for bare electrodes and deposit analyses for covered electrodes.*

[b] *Total other elements, including the elements marked with footnote [b], shall not exceed the value specified.*

[c] *This electrode available only as straight length bare electrode.*

[d] *This electrode also available in bare coiled form for use with the inert-gas metal-arc (consumable electrode) process.*

[e] *This AWS-ASTM classification is intended to be identical with the same classification that appears in the specifications for copper and copper-alloy welding electrodes.*

[f] *One or both of these elements may be present within the limits specified.*

AWS-ASTM Classification	Carbon, per cent	Manganese, per cent	Cobalt, per cent	Tungsten, per cent	Nickel, per cent	Chromium, per cent	Molybdenum, per cent	Iron, per cent	Vanadium, per cent	Copper, per cent	Aluminum, per cent	Zinc, per cent	Silicon, per cent	Lead, per cent	Tin, per cent	Phosphorus, per cent	Other Elements
ECuSn-C[a]	...	[b]	...	...	[b]	...	...	[b]	...	remainder	0.01[b]	[b]	[b]	0.02[b]	7.0 to 9.0	0.35	0.50
ECuSn-E[a]	...	...	...	...	...	...	...	...	...	remainder	...	...	...	14.0 to 18.0	5.0 to 7.0	0.30 to 0.50	0.50
ENiCr-A	0.30 to 0.60	...	1.50	...	75.0 to 85.0	8.0 to 14.0	...	1.25 to 3.25	2.00 to 3.00 per cent boron				1.25 to 3.25	...	...	...	0.50
ENiCr-B	0.40 to 0.80	...	1.25	...	71.0 to 81.0	10.0 to 16.0	...	3.00 to 5.00	2.00 to 4.00 per cent boron				3.00 to 5.00	...	...	...	0.50
ENiCr-C	0.50 to 1.00	...	1.00	...	65.0 to 75.0	12.0 to 18.0	...	3.50 to 5.50	2.50 to 4.50 per cent boron				3.50 to 5.50	...	...	...	0.50
RFe5-A	0.7 to 1.0	0.50	...	5.0 to 7.0	...	3.0 to 5.0	4.0 to 6.0	remainder	1.0 to 2.5	...	...	...	0.50	...	...	...	1.0
RFe5-B	0.5 to 0.9	0.50	...	1.0 to 2.5	...	3.0 to 5.0	5.0 to 9.5	remainder	0.8 to 1.3	...	...	...	0.50	...	...	...	1.0
RFeCr-A1	3.7 to 5.0	4.0 to 8.0	...	...	...	27.0 to 32.0	...	remainder	...	...	...	...	1.0 to 2.5	...	...	...	1.0
RFeCr-A2	3.7 to 5.0	1.00	...	...	2.5 to 4.5	27.0 to 32.0	...	remainder	...	...	...	...	0.5 to 2.0	...	...	...	1.0
RCoCr-A	0.9 to 1.4	1.00	remainder	3.0 to 6.0	3.0	26.0 to 32.0	1.0	3.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
RCoCr-B	1.2 to 1.7	1.00	remainder	7.0 to 9.5	3.0	26.0 to 32.0	1.0	3.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
RCoCr-C	2.0 to 3.0	1.00	remainder	11.0 to 14.0	3.0	26.0 to 33.0	1.0	3.0	...	...	...	...	0.4 to 2.0	...	...	...	0.50
RCuZn-E	...	0.30	...	...	...	...	...	1.50	...	56.0 min	0.01[a]	remainder	0.04 to 0.25	0.05[a]	2.00 to 3.00	...	0.50
RCuSi-A[b]	...	1.5[c]	...	...	[c]	...	...	0.5	...	94.0 min	0.01[a]	1.5[c]	2.8 to 4.0	0.05[a]	1.5[c]	[c]	0.50
RCuAl-A2[b]	...	...	...	...	...	...	...	1.5	...	remainder	9.0 to 11.0	0.02	0.10	0.02	...	...	0.50
RCuAl-B[b]	...	...	...	...	...	...	...	3.0 to 4.25	...	remainder	11.0 to 12.0	0.02	0.10	0.02	...	...	0.50
RCuAl-C	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	12.0 to 13.0	0.02	0.04	0.02	...	...	0.50
RCuAl-D	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	13.0 to 14.0	0.02	0.04	0.02	...	...	0.50
RCuAl-E	...	...	...	...	...	...	...	3.0 to 5.0	...	remainder	14.0 to 15.0	0.02	0.04	0.02	...	...	0.50
RCuSn[b]	...	[c]	...	...	[c]	...	...	[c]	...	94.0 min	0.01[a]	[c]	[c]	0.05[a]	4.0 to 6.0	0.20 to 0.30	0.50
RCuSn-D	...	...	...	...	...	...	...	...	...	88.5 min	0.01[a]	...	...	0.05[a]	9.0 to 11.0	0.10 to 0.30	0.50
RCuSn-E	...	...	...	...	...	...	...	...	...	remainder	...	...	...	14.0 to 18.0	5.0 to 7.0	0.30 to 0.50	0.50
RNiCr-A	0.30 to 0.60	...	1.50	...	75.0 to 85.0	8.0 to 14.0	...	1.25 to 3.25	2.00 to 3.00 per cent boron			...	1.25 to 3.25	...	...	...	0.50
RNiCr-B	0.40 to 0.80	...	1.25	...	71.0 to 81.0	10.0 to 16.0	...	3.00 to 5.00	2.00 to 4.00 per cent boron			...	3.00 to 5.00	...	...	...	0.50
RNiCr-C	0.50 to 1.00	...	1.00	...	65.0 to 75.0	12.0 to 18.0	...	3.50 to 5.50	2.50 to 4.50 per cent boron			...	3.50 to 5.50	...	...	...	0.50

[a] *Total other elements, including the elements marked with footnote [a], shall not exceed the value specified.*

[b] *This AWS-ASTM classification is intended to be identical with the same classification that appears in the specifications for copper and copper-alloy welding rods.*

[c] *One or more of these elements may be present within the limits specified.*

Courtesy Rankin Mfg. Co.

ROOTER shank, boot and tooth, hardfaced with iron-base highquality filler metal, protects original parts from wear through both abrasive sands and rocky terrain.

hardness and oxidation resistance. Because these alloys are comparatively expensive, use should exclude areas where less severe conditions permit use of ferrous alloys.

CoCr-A filler metal is generally used for contact surfaces of exhaust valves in aircraft, and gasoline and diesel bus or truck engines. This same surfacing alloy works well in steam engine valve trim or pump shafts, and on other parts where corrosion and erosion are present.

Higher carbon varieties, CoCr-B and -C, are used for services necessitating greater hardness and abrasion resistance but lower impact demands.

Hardness of oxyacetylene deposits is generally greater than that produced by arc welding due to greater and more variable base metal dilution obtained with the arc. Above 1,200 F, the hot-hardness superiority of these alloys and their better creep resistance makes them popular for high-temperature applications.

Oxidation resistance is good up to 1,800 F because of the high chromium content. While these surfacing deposits stand up well when subjected to leaded gasoline combustion products, they may not do as well when exposed to boron fuel exhaust gases. Corrosion resistance is good in certain media where stainless steels would be appropriate. But corrosion, like wear, is an area where expert counsel and substantiation by field tests is the only sure procedure.

Although abrasion resistance improves with higher carbon content, this is a minor quality in choosing CoCr hardfacing alloys. Metal-to-metal wear is excellent, both because of high polishing qualities and low friction. Machining of CoCr-A deposits can be done with sintered carbide tools while type C deposits can be finished by grinding only.

Tungsten carbide is the best material for surfacing applications involving severe abrasion. These filler metals can be applied by several welding processes and are available in various forms: tungsten carbide inserts, steel tubes filled with various mesh size tungsten-carbide particles, or as tungsten carbide powders.

Courtesy Rankin Mfg. Co.

GYRATORY crusher mantle being reconditioned with iron-base low-alloy hardfacing electrodes. Mantle has been retouched each year since 1950 and is still in operation.

Oxyacetylene deposits are apt to be more wear-resistant than arc welded deposits since the particles tend to be more uniformly distributed because of the lower heat. There is also a tendency for the tungsten carbide particles to dissolve in the superheated, arc-deposited steel matrix. Sometimes each particle is protected with a refractory coating in the electrode tubes to prevent excessive solution in the matrix during arc welding.

The matrix—usually steel but nonferrous at times—provides impact resistance in the carbide filler metals, making shock resistance most important when large carbide particles are surrounded by a steel matrix.

There are two schools of thought regarding mesh size of particles. One maintains that fine mesh sizes give best wear resistance; the second claims they do not, and states that choice should be determined by the need for smoothness or cutting edges in the deposit. There is evidence, however, that coarse tungsten carbide deposits will cut through extremely hard earth formations such as granite, coal and hard shale.

Special surfaces for bearings, corrosion resistance or wear resistance are deposited with copper-base metals. Aluminum-bronzes cover a broad range of bearing and wear-resistance applications. Various alloys ranging from 130 to 390 BHN are being manufactured, and are usually applied by arc welding. Overlays and inlays are adapted to simple bearing surfaces or may be chosen for the heavy-duty services encountered in gears, cams, sheaves, wear plates and dies.

Silicon-bronzes are selected almost exclusively for their corrosion resistance. Tin-bronzes, while suitable for bearing surfaces, are sometimes found in corrosion-resistant duty and very seldom as a wear-resistant surface. Leaded-bronze of the CuZn-E type is included for bearing purposes only because the porous deposits held oil for extra lubrication in locomotive journal boxes—a fast disappearing application.

Hardness varies with welding processes, and gas welding generally provides the harder deposits. Hot-hardness is not an attribute of copper-base surfacing filler metals. Impact properties of CuSi and the rela-

Courtesy Stoody Co.

SWING hammers rebuilt with manganese rounds and FeMn electrodes, then hardfaced to original size with tungsten-carbide filled tubular electrodes.

tively softer CuAl filler metals are good, the others are fair to poor.

Best oxidation resistance is provided by the CuAl types; CuSi is fair. Corrosion resistance of this group is good in many environments, except for the CuSn-E and CuZn-E classifications. Severe abrasion resistance is known to ruin copper-base alloy surfaces.

Metal-to-metal wear characteristics are generally good, since bearings are kept somewhat softer than the mating member, causing wear to occur in the bearing. Except for the hardest CuAl alloys, all filler metals in this group produce machinable deposits.

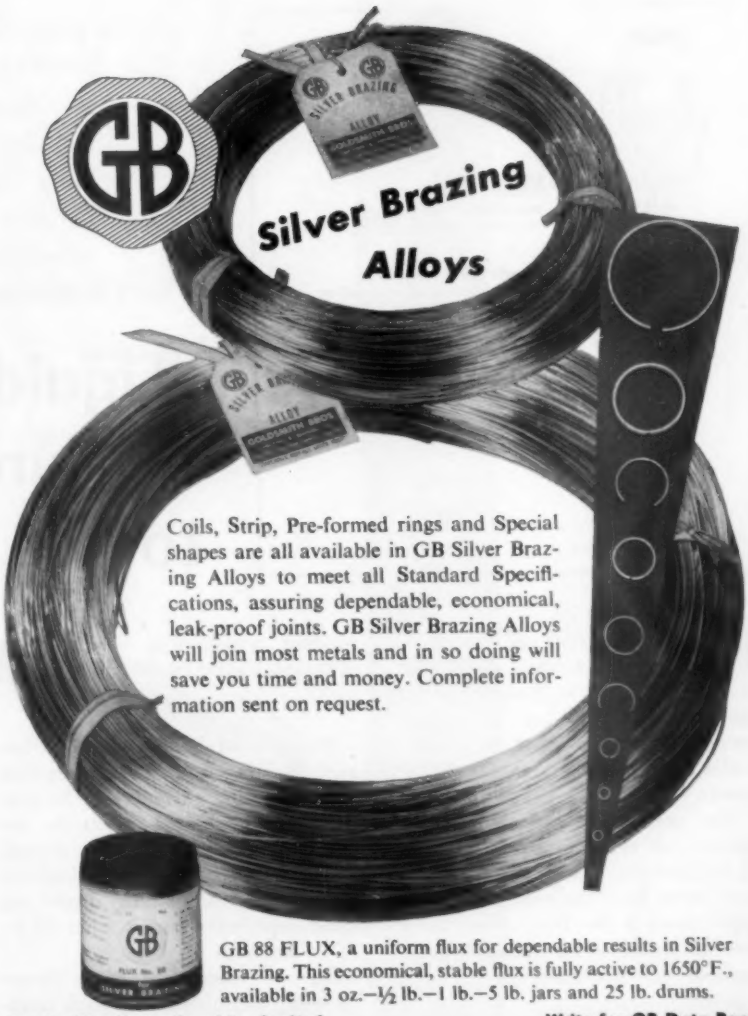
Only nickel-chrome-boron filler metals appear in the current AWS specification for nickel-base hardfacing alloys. Although not classified, the nickel-copper filler metals are often used to overlay wrought and cast steel as well as cast iron. Such overlays are common for facing vessel outlets, and as trim on valves.

"Hastelloy C" (nickel, chromium, molybdenum, iron and tungsten; AWS-ASTM designation E3N12) is also left out, even though it is used extensively as a hardfacing electrode for all hot-working applications including hot-forge dies, hot shear blades and blast furnace bells. (See article on the E3N12 alloy in our next issue.)

The classified nickel-chromium-boron filler metals are available as rods for gas welding; bare or coated electrodes for manual arc welding, or powders for metal spraying. Metal-to-metal wear resistance is good, as is low-stress scratch-abrasion resistance, corrosion resistance (except hydrochloric acid), and hot-hardness. Common applications include seal rings, cement pump screws, valves, screw conveyors, gear teeth, scraper blades, cast iron wire capstans, and pump plungers.

Metals in this group have only light impact resistance, while oxidation resistance is good up to 1,750 F. Softer deposits are machinable under careful control with carbide tools, but harder deposits must be ground.

Since so many desirable attributes exist, the engineer must choose the most important and select filler metal accordingly. Expert counsel in choosing proper hardfacing filler metals and in backstopping corrosion problems is strongly recommended.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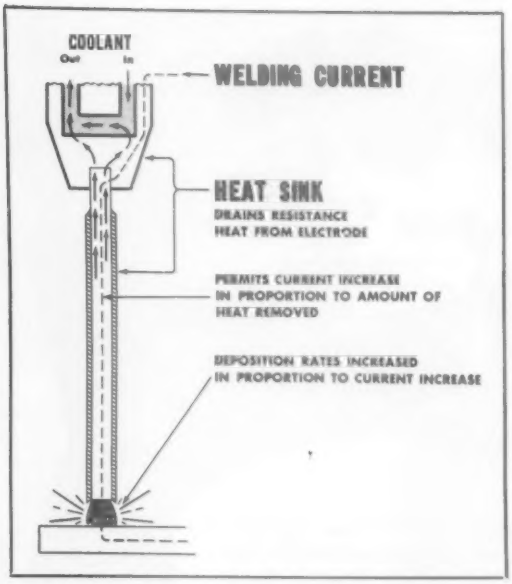

On page 98 in the April issue of WELDING ENGINEER, the Editors promised a detailed description of the new "LC" welding system now being produced by Bernard Welding Equipment Co. of Chicago. Here it is. (*And on page 49, be sure to read all about Lincoln Electric Co.'s new automatic "Innershield" process.*)

"Liquid Cooling": Bernard's answer to hot, slow welding

PRINCIPAL FEATURE of the "LC" manual arc welding system recently introduced by Bernard Welding Equipment Co. is a cooling method that drains heat from electrodes and permits higher welding speeds.

The process is designed for all grades and types of common steel, ¼ in. thick and heavier. The Chicago firm states that "its speed on many applications is two times faster than that obtainable with semiautomatic methods and processes."

Bernard admits that "LC" welding speed is less than that obtained with fully automatic submerged-arc processes, but it feels that "from an overall labor cost standpoint, the system's versatility more than offsets this difference in speed on many short-run applications."

Key to the heat-draining feature of the new method is a "heat sink" maintained in the end of a special electrode holder by water coolant circulating through the electrode holder. Heat which develops in the top third portion of the electrode as the remainder is deposited, is induced to flow to the low-temperature level at the gripped end of the electrode.

Absorbed and carried away in the circulating coolant (which flows under a 30-psi pressure), heat is dispersed by an "LC Cooler". This component is similar in all respects to the unit for cooling Tig and Mig welding which was described in WELDING ENGINEER, December, 1957, p. 81.

Because of heat removed, Bernard Welding Equipment states that higher welding currents can be conducted through the electrode resulting, naturally, in faster deposition rates. Depending upon electrode size and current volume, deposition speed reportedly ranges from 10 to 28 lb per hour.

Bernard cites a further factor "possibly as important as high welding speeds": the handle of an "LC" electrode holder will not heat beyond 4 or 5 deg above body temperature. "Non-productive down-time due to overheated electrode holders," says the firm, "has therefore been eliminated."

The company stresses the fact that all resistance heat build up in an electrode cannot be drained by the "LC" system. "The system does, however, drain enough heat so that a ¼-in. coated electrode can conduct—and safely be deposited with—the same amperage used for a 3/32-in. welding wire in semiautomatic equipment.

"Since 'LC' permits use of currents higher than the accepted maximum of 500 amp with certain types

MATERIALS required for "LC" welding: a self-contained cooling unit; special electrode holder; hose-cable assembly, and hose-cable adaptor.

You don't have to

weld it...

you just point it!

STOODY SEMI-AUTOMATIC HARD-FACING

The fast way to take the work out of welding!

Hard-facing with the new Stoody Semi-Automatic Wires is *that* easy! You simply "aim" the wire and strike the arc. The semi-automatic machine does the rest... automatically feeds the wire at the correct rate, lays down a sound deposit—stringer bead or wash pass.

Man, it's a weldor's dream! No fluxes, no flux dams. Perfect visibility of the weld every inch of the way. And talk about speed—2 to 4 times faster than manual welding... ideal for covering big areas quickly, extremely handy for maintaining equipment between shifts! No changing of electrodes either... welding is continuous as long as there's wire on the reel and this naturally means an end to stub end waste.

With Semi-Automatic's low heat input and low penetration, there's less dilution of the deposit. *Less dilution* means *higher alloy content* with increased wear resistance, usually superior to manual electrodes of similar analysis. There's a complete line of wires with just the right analysis for every job!

TRY SEMI-AUTOMATIC HARD-FACING THIS EASY WAY—Your Stoody dealer will arrange for a semi-automatic demonstration in your plant—on your own job. (Check the yellow pages of your phone book for nearest Stoody Dealer.) Let him prove how Stoody Semi-Automatic Hard-Facing can cut your maintenance costs!

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APPLICATION of "LC" welding system as a dual set-up by a Midwest fabricator of structural steel.

of ¼-in. electrodes, however, deposition speed can therefore be greater than that obtained with 3/32-in. wire in a semiautomatic gun. Further, electrode size used by semiautomatic processes is generally limited to a 3/32-in. maximum. Freedom of gun manipulation is seriously hampered by thicker electrodes."

Electrodes with proportionately greater cross-sectional areas than the ¼-in. size (*e. g.*, 5/16 and ⅜-in.-diameter types) can, of course, conduct proportionately higher welding currents. Here's a Bernard example: a ⅜-in. E6020 type can be deposited at a rate of 30 lb per hour, using an 800-amp arc.

Says the firm: "The 'LC' welding system does not require a particular type of welding current—often the case with most semiautomatic processes. The system can be connected to any conventional a-c or d-c welding current source. And, if current is d-c, either reverse or straight polarity may be used; the choice is made to suit the electrode."

Uses of an "LC" system are said to be unlimited, but Bernard strongly advises its application on jobs where currents of 400 amp or greater are required. Maximum rating for the model now on the market ("LC-700") is 750 amp at a 60% duty cycle. And, because of this recommendation, the firm states that electrodes smaller than ¼ in. in diameter "should not be used" with the currently available model.

Weld quality obtainable with "LC" arc welding? Reports Bernard: "Welding amperage used by the new system should not be increased to resistance-heat an electrode above 'safe' temperature reached with normal amperages on ordinary equipment. If this happens, physical properties of deposited weld metal can be reduced.

"The permissible current increase," the company report continues, "varies from 10 to 40%, depending on type of electrode coating. Generally, permissible current increase is less for a celluose type than for strictly mineral types."

But Bernard makes no specific current recommendations for specific electrode types and sizes, (*1*) "because of the broad variety of electrode types—and the variations found in each," and (*2*) "because electrodes of a particular type, but made by different manufacturers, have different 'safe' operating temperatures (*i. e.*: a particular electrode type made by one manufacturer may be deposited with a higher amperage than the same type made by another firm, yet produce higher physical values at the higher amperages)."

The firm makes this further note regarding weld quality: "Difference in flux chemistry that influences shielding efficiency—plus volume and type of deoxidizing agents in the flux, and degree of stabilization given to these agents when processing flux before and after its application to a core wire—are factors of extreme importance.

No external deoxidizing agents . . . new control features . . . and speeds up to 300 ipm are the main features in Lincoln's

New automatic process for arc welding steel

SPEEDS UP TO 300 ipm can reportedly be obtained when arc welding steel with a new automatic welding process developed by Lincoln Electric Co.

Main factor in the "Innershield" process is a flux-containing, coiled wire electrode which produces vapor shielding for an open arc. No fluxing or shielding agents are added from external sources; all materials are contained in the electrode.

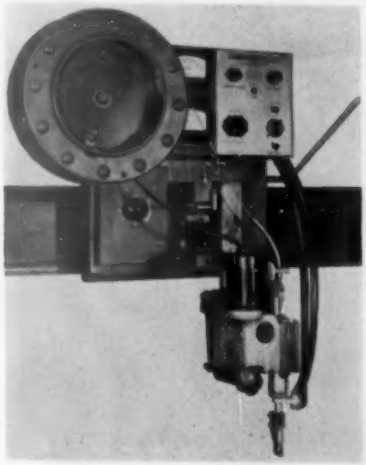
This elimination of external applications, plus the equipment's control features and high feed rate, produces the high welding speeds, the company states.

Speeds on 14-gage horizontal lap welds range between 150 and 300 ipm, where optimum conditions can be obtained. Lap welds in heavier materials, such as 3/16-in. plate, range around 100 ipm.

Another advantage cited by Lincoln: the elimination of granular flux also prevents the wear and operating difficulties in fixtures or welding machinery often caused by this abrasive material.

In operation, this process maintains a visible arc between the work and the continuous electrode. Some flux ingredients vaporize in the arc to shield it, while others are absorbed into the molten pool to act as fluxing agents.

Resulting welds, according to the



VIEW of automatic head, controls and self-propelled carriage for Lincoln's new "Innershield" process. Elimination of flux prevents wear and is one advantage offered by the machine.

WELDOR regulates machine during welding of light-gage (16-gage to ½ in.) materials. New process is reportedly ideal for welding materials of this size.

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Iron-Powder Electrodes

Weldors can really pour it on with P&H Iron-Powder Electrodes! Faster deposition and superior weldability make them easy to handle in any position—enable operators to produce X-ray welds by simply dragging the electrode. Added benefits: a minimum of spatter and low stub loss.

Welds are smooth and practically self-cleaning — possess high strength with greater impact at low temperatures. Get Bulletin R-29. Write Dept. 302B, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

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As you can see at the right, pre-war welders had considerably more guts than most of today's "so-called" heavy-duty units. If you need real heavy-duty machines–ask yourself

Where'd the GUTS .....

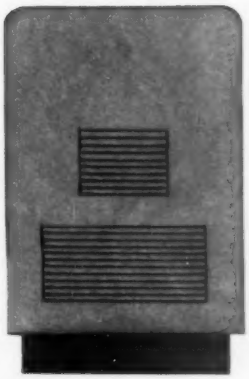
...you can still get 'em

Today's A. O. Smith Welders surpass even the best of pre-war units

PRE-WAR WELDER*	POST-WAR A. O. SMITH*
Average Copper Coil Weight 180 lbs.	Copper Coil Weight 186 lbs.
Height 46 in.	Height 47½ in.
Temperature rise — 55°	Temperature rise — 55°

*500 amp heavy-duty a-c welder

NOTE: A. O. Smith also offers the Challenger line of a-c welders competitive in size and strength with today's "so-called" heavy-duty units.



PRE-WAR WELDERS*

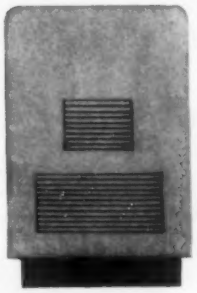
Average Copper Coil Weight 180 lbs.

Average Height 46 in.

Average Temperature rise 55°

*Heavy-duty a-c (500 amps)

go?



POST-WAR WELDERS*

Average Copper Coil Weight 100 lbs.

Average Height 40 in.

Average Temperature rise 120°

*Heavy-duty a-c (500 amps)

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The amount of copper in the coils is one of the largest single factors in the life expectancy and efficiency of a welding machine.

While many other types of equipment, through use of new materials and new design, have become smaller without any sacrifice in efficiency or service life — *welding machines are an exception!*

A. O. Smith welding machines have practically twice as much costly copper in their coils as other welders . . . they offer many other outstanding additional advantages. These advantages include 1/6-hp, totally-enclosed, ball-bearing, pre-lubricated fan motor (biggest in the industry) and 18-inch, big volume fan . . . Jet-stream ventilation . . . silicone insulation . . . and 75 open circuit volts.

Result, though rated at 60% duty cycles, these A. O. Smith welders could be operated at 100% duty cycles and still out-live competitive machines operating at 60%. There's nothing on the market today that can compare. Write direct or contact your man from A. O. Smith for conclusive evidence.

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Ampco-Trode 160 reclaimed this 3,000-pound board drop ram.

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Guide to Ampco-Trode* Characteristics

AMPCO-TRODE 160

DEPOSIT: High strength and good ductility with average hardness of 160 Brinell. Excellent bearing characteristics — resists squashing-out.

APPLICATION: Overlaying bearing surfaces subject to normal wear and shock. Joining aluminum bronzes, ferrous or non-ferrous fabrications, and dissimilar metals.

AMPCO-TRODE 200

DEPOSIT: Average hardness of 200 Brinell. Highest strength-hardness-ductility ratio of the Ampco-Trode series. Excellent wear-resisting characteristics.

APPLICATION: Widely used for bearing overlays where extreme wear and high pressures are encountered.

AMPCO-TRODE 250

DEPOSIT: Higher yield strength and hardness (average 250 Brinell) than Ampco-Trode 200, with lower tensile strength and ductility typical of the aluminum bronzes.

APPLICATION: Extreme bearing applications where very high pressures are encountered operating against hardened steel surfaces.

AMPCO-TRODE 300

DEPOSIT: Highest yield strength and hardness (average 300 Brinell) of the Ampco-Trode series.

APPLICATION: Fabricating new, or rebuilding worn, ferrous dies used for forming or drawing stainless steels and other clean metals. Other severe-wear applications.

*Reg. U. S. Pat. Off.

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company, are dense and sound. Mechanical properties are said to be comparable to those of submerged-arc welds, but lack the typical heavy slag of this process.

The company states the process and equipment were developed to reduce welding cost through high speeds on jobs within its range and application.

The two main characteristics of the process—which can make welds ranging from lap welds in 16-gage material to butt welds in ½-in. plate—are high speed and a minimum of deposited metal. Typical jobs are small-diameter circular or roundabout welds, automotive parts and pressure tanks.

Equipment includes a new welding head to control feed, and a motor-generator power source which supplies 400 to 1,000 amp current. Control circuit for the head will adapt readily to machines and fixtures for high-volume production welding.

The head also provides an inching speed control to aid "hot-start" arc striking, and a special timer and current control to set procedures for crater filling and bead overlapping.

A cycle timer can be added to the equipment by use of attached terminals. Manual controls operate the head for set-up or experimental work and head and controls may be mounted on standard travel carriages.

TYPICAL application of Lincoln's new welding process is pictured above. Roundabout lap weld was used on 5-in. diameter tank of ⅛-in. plate. Using 700 amp current, machine attained speed of 140 ipm.

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Do's and don't's of hardfacing are spelled out in clear language by an industry pioneer.

A hardfacing field-guide for beginners

By D. B. Rankin
Rankin Mfg. Co.
Alhambra, Calif

THE AMBITIOUS NEWCOMER to hardfacing must never forget, not only the importance of hardfacing itself, but also the importance of . . . hardfacing correctly . . . knowing *when* and *what* to hardface . . . choosing the right rod or electrode, and in the correct diameter . . . making proper amp and polarity settings . . . and of making the right number of passes.

With these guides, the neophyte eliminates all obstacles between himself and a piece of work which will take immense wear and abrasion. Examine these signposts point-by-point.

Importance of hardfacing. This is the reason you hardface: actual field experience has proved that the most economical way to conserve equipment is to overlay its critical part with a surfacing material tougher than the base metal.

This will not only lengthen the part's service life but also keep it operating at, or near, its original dimensions. Downtime decreases because fewer repairs need be made.

Importance of hardfacing correctly. Photographs included in this article show hammers employed in a mill for regrinding used welding-flux.

All did the same work, at the same time, and under the same conditions. Three of the units, however, were correctly hardfaced and did their jobs well; the other three—also hardfaced—were failures.

What made the difference? The first set lasted longer on the job simply because the weldor followed proper procedure for selecting proper hardfacing materials and because he applied them correctly.

Importance of knowing *when* and *what* to hardface. Hardfacing alloys are basically designed for application on surfaces which tend to wear rapidly. The process generally works equally well on new parts. (*Exception:* close tolerances sometimes make hardfacing impractical until some wear has occurred.)

There is a prevalent belief that any steel part can be hardfaced. However:

(a) *Do not* try to save units so badly worn that they need more than three or four passes of hardfacing material to restore them to original dimensions. Hardfacing is intended to protect surfaces, not replace them.

(b) *Do not* attempt to hardface metal so over-hardened by irregular factory techniques, or by welding strains, that it shows signs of checking or chipping.

(c) *Do not* hardface heat-treated alloy steels without annealing, or without making test welds on scrap pieces.

Most equipment—particularly that made of manganese steel, which requires a relatively large amount of work impact to harden it to its best abrasion-resistant condition—should be hardfaced before being put into use.

When hardfacing at any time, be sure abrasive action works only on the hardfacing material. Watch wear closely and rebuild surfaces when parent metal is reached. Or, better still, have regular maintenance periods when all worn places are touched up. This will insure peak unit efficiency and hold down welding costs.

Importance of choosing the right rod or electrode and in the correct diameter. In Fig. 1 are two mill hammers. Both were exposed to the same degree of wear. One shows some signs of abrasion, but will withstand further punishment. The other is worn away. *The only difference between them was the hardfacing rods used.*

Choosing the proper electrodes or rods for any job is complicated by extensive listings offered by manufacturers. Some even recommend two

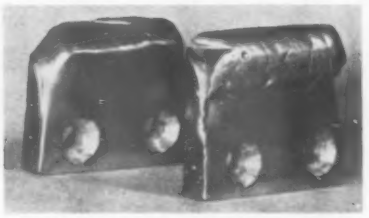

FIG. 1 Mill hammers run side-by-side. One (right) was hardfaced with right material, the other was not.

FIG. 2 Although hardfaced with same material, right hammer is less worn because correct welding procedures were used.

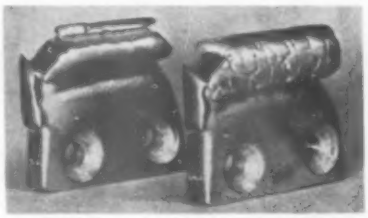

FIG. 3 Front hammer received two passes instead of one. Extra wear was gained despite use of same hardfacing material.

CHECK POINTS

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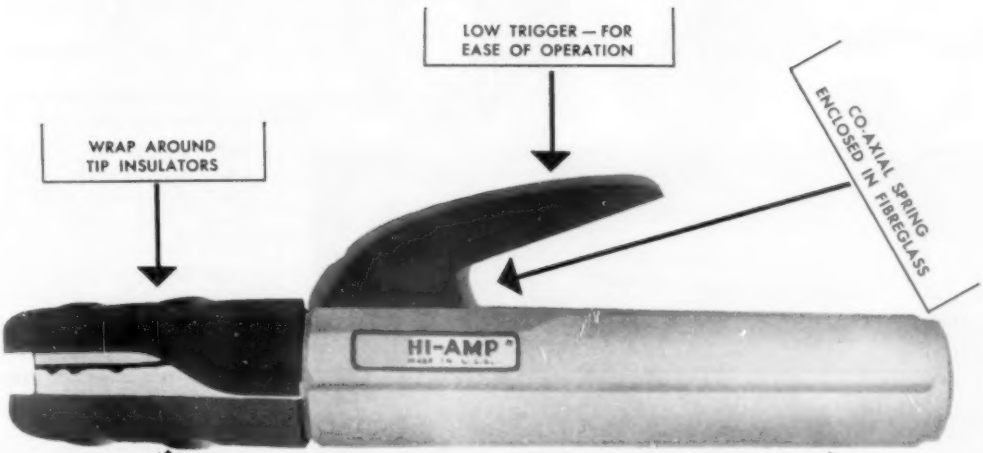
BUY HI-AMP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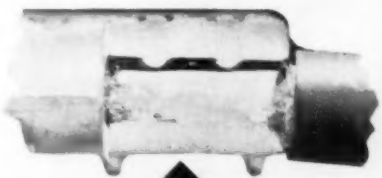

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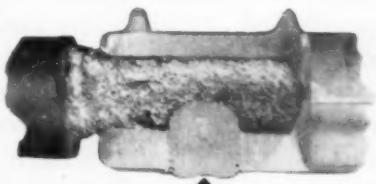

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or three rods for a single application because of divergent conditions.

The only way to be sure of using the best alloy is to run a series of well-planned, carefully studied test welds on the job at hand.

There are a number of factors to be considered on such tests. Most crushing rolls, for example, stay in service for months. Some, however, are consumed in less than one work shift. In hardfacing rolls, then, it was decided that a lower priced material with moderate wearing qualities was *not* as economical as a more costly rod, which, however, removed the necessity of mid-shift shutdowns.

Avoid using oversize rod diameters for any job. Such rods require higher amperages that may be undesirable. Excessive heat seriously affects manganese steel, causes heavy parent metal pickup, and sometimes causes warpage.

On the other hand, do not use a smaller rod than necessary. The proper rod diameter cuts welding time and costs. As rod diameter increases, surface speed also increases as shown in the following table taken from laboratory tests.

Rod diameter	Amps drawn	Grams of metal laid per minute
1/8 in.	120	21
5/32 in.	150	36
3/16 in.	190	46
1/4 in.	240	67

On an actual job, it took 90 minutes to hardface a shovel tooth using a 3/16-in.-diameter electrode. The same job was done in 67 minutes using the 1/4-in. electrode—a speed increase of 30%.

Importance of making proper amp and polarity settings. In Fig. 2 are a pair of mill hammers: the hardfacing on one is worn through; the other is almost intact. Yet, *both hammers were faced with the same material, but application procedures differed.*

Generally, rely on the manufacturer's recommended application methods for best results with rods. In the final analysis, however, the user must determine—by actual field tests—what methods are ideally suited to individual work problems.

A variable that must be considered is the welding machine's polarity setting.

When a rod performs properly on

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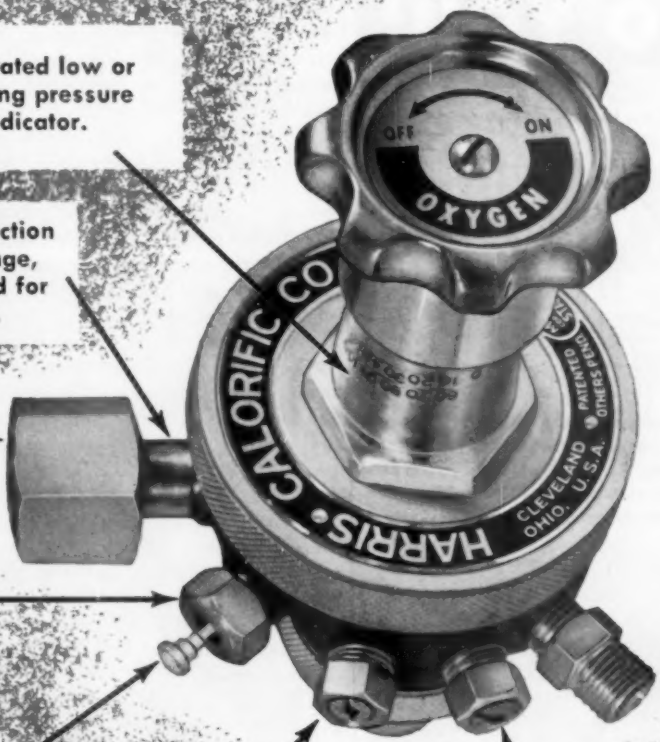

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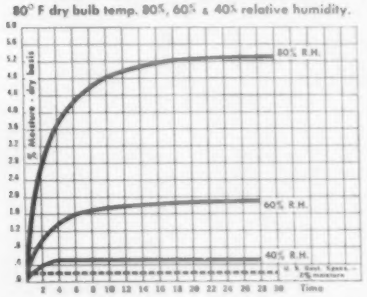
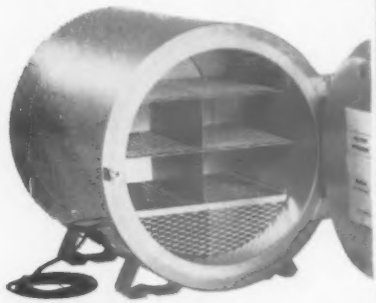


The moment you unpack a mineral-coated electrode, it begins to absorb moisture. As the chart shows, rods can pick up as much as 13 times allowable moisture content within two hours!



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only one polarity that, naturally, is the one to be used. If it can be run on either polarity there are still advantages in selecting the correct procedure.

Straight polarity deposits metal faster, dilutes from the parent metal less, and builds up higher. These are characteristics desirable in hardfacing. However, most bi-polarity rods operate more smoothly on reverse. Reverse polarity helps achieve relatively thin, smooth deposits with a sound, strong bond and a retarded cooling rate.

When hardfacing with higher amp settings, the metal is deposited faster but more heat is on the parent material, causing it to dilute with the hardfacing metal. Too much dilution weakens the surface to a point where its wearing qualities are almost completely destroyed.

Nevertheless, there are some hardfacing rods whose best deposits are made under conditions of slow cooling. For these, higher amp settings and reverse polarity are usually preferable.

In the majority of cases, however, it is more desirable not to overheat the parent metal. This is particularly true of manganese steel, which is harmed by exposure to higher temperatures. Nearly all hardfacing overlays benefit in proportion to their cooling speed.

There is, for example, a case when a surface's wearing life was *tripled* by using 50 amp less heat.

"All right," the beginner might say, "so I get three times more wear. But what about the extra welding time it takes to work at lower amps?"

Let us answer that question by analyzing a typical weld history. Operated at 175 amp, a 3/16-in.-diameter rod was consumed in 62 seconds. The same diameter rod, used at 125 amp, was consumed in 76 seconds. Thus the time difference between them was 14 seconds per rod, or approximately 1.6 minutes per lb.

Using the lower setting to apply 100 lb of hardfacing material on a set of crushing roll shells, welding time would be 2⅓ hours. While this extra time seems important at the job site, it becomes less so if, thereby, shell life is extended from one month to two months, or even extended a week.

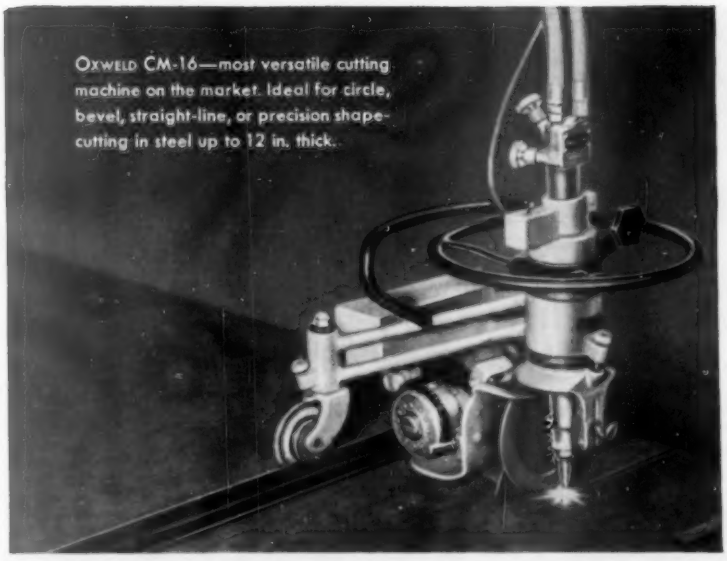
Importance of making the right number of passes. Fig. 3 shows two hammers subject to the same wear. *One received only one pass. Two passes were made on the other with a cooling to room temperature between them.*

This, of course, doubles the original investment in hardfacing. Also, it may result in buildups higher than desired and may set up unwanted strains in the parent metal.

These are drawbacks, true. Yet some striking results have been obtained by multi-passing . . . it has been found, that, in some cases, a double-pass surface lasts three or four times as long as a single pass surface.

This may not be true in every instance, but we know of no occasion when a double pass has not lasted twice as long as a single pass.

HARDFACING tractor lugs by arc welding. Additional wear is obtained by coating lug's surface with metal to resist abrasion and impact. *But*, if correct hardfacing methods are not followed, and improper materials are used, overlay will soon wear through. How to avoid this is discussed by an acknowledged hardfacing expert in this article.



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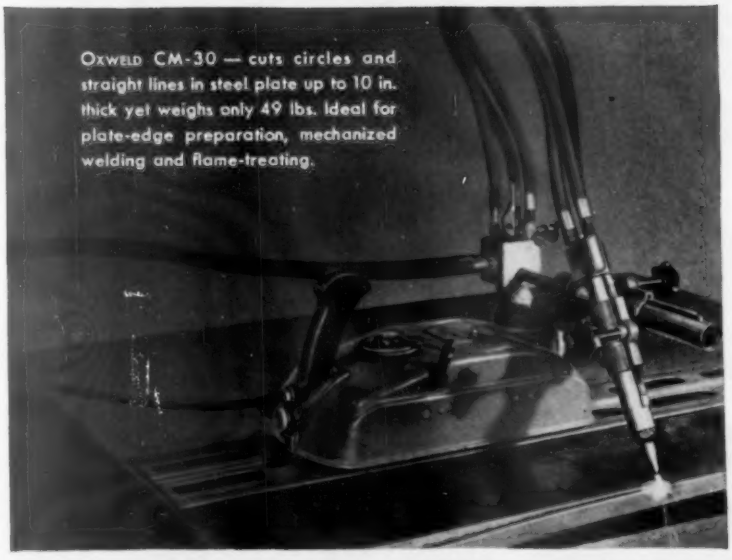

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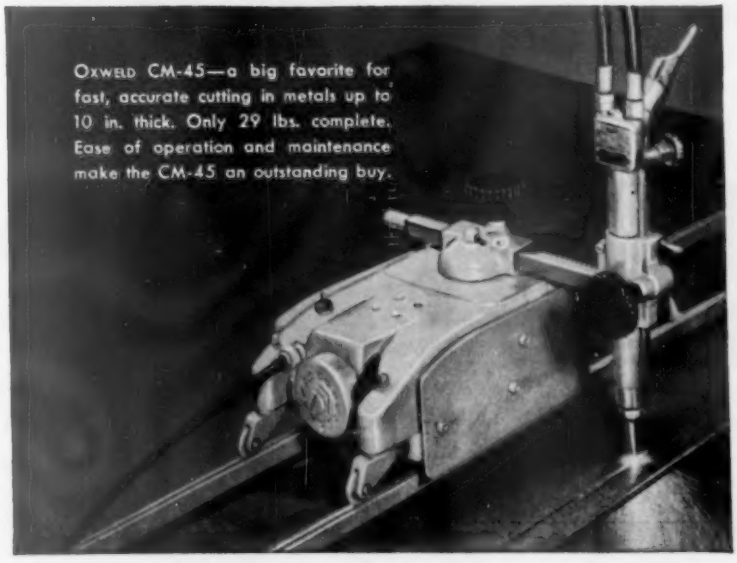

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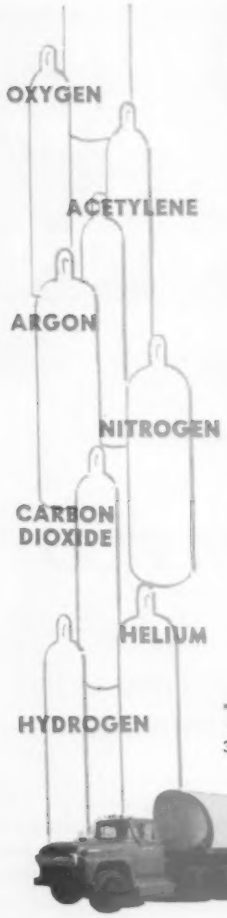

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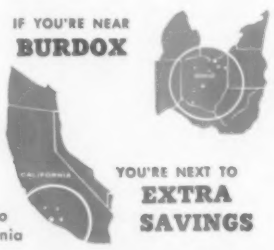

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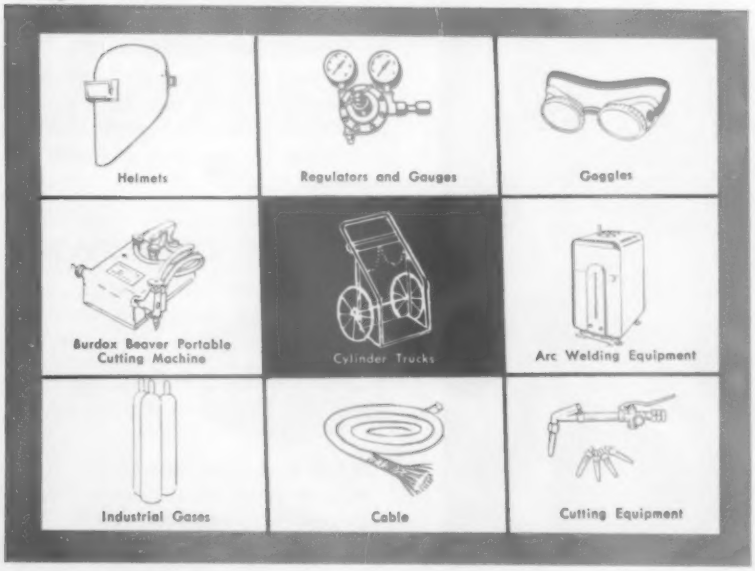

STERN of *H. B. Jordan* shows welded hull, rudders, struts and propellers.

Towboat hulls all-welded

RIVER BOATS have come a long way since the days of Mark Twain.

Three of the country's first inland waterway towboats with all-welded stainless steel hulls were designed and built by St. Louis Shipbuilding Co. for United States Steel Corp.

One of the more important aspects of the hull fabrication was elimination of stub loss on the expensive stainless steel electrodes. Cost savings were considerable since 3,000 lb of these electrodes were used on approximately 10,500 ft of welding.

For its welding jobs, the shipbuilding company maintains 21 Vickers welders in its yards.

Stainless steel was specified for all parts exposed to water from the main deck down, including shafting, struts, rudders and the modified scow bow.

First to be completed was the harbor boat *USS-1*, 70 ft in length by 19 ft wide with an 8½-ft hull depth. Hull fabrication required 18 tons of ⅜, 5/16 and ¼-in. plate.

The other two boats, *H. B. Jordan* and *S. M. Jenks*, measured 120 ft in length by 27 ft wide with a 9 ft hull depth. About 40 tons of plating and 8 tons of stainless steel forgings and castings were used in each.

The boats were built for service on the Ohio and Monongahela rivers.

WELDOR puts finishing touches on hull of third boat *S. M. Jenks*.

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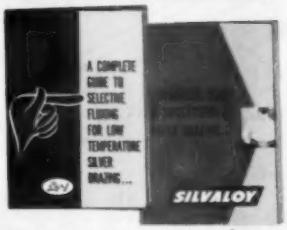

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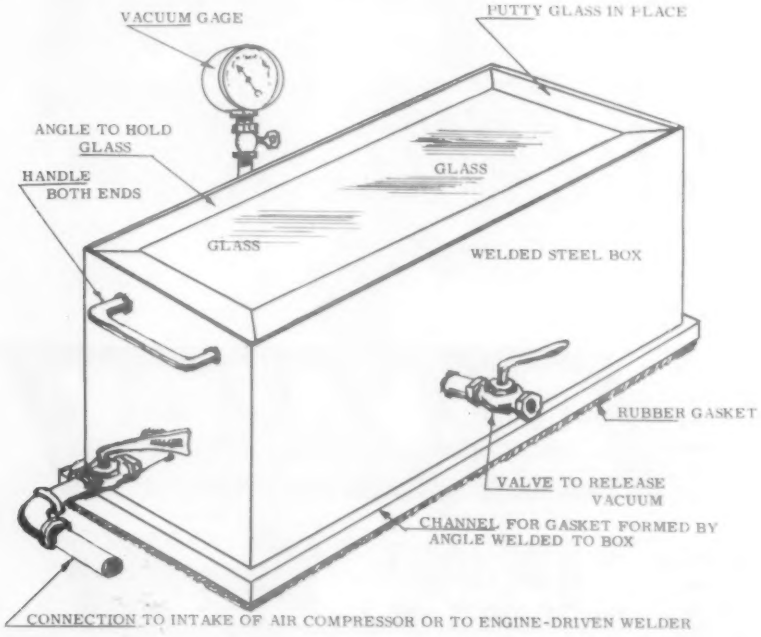
APW — LOW TEMPERATURE SILVER BRAZING ALLOYS AND FLUXES

Fabricating a vacuum-test chamber



Question:

How do I check welded seams in a tank bottom for leaks? Where can I buy test equipment?

Answer:

Bottom seams of all field storage tanks are tested by means of a vacuum box. The box is placed over the tank's bottom, weld areas are coated with soap suds, and all air is evacuated from the box. Any leaks will be revealed by bubbles along the weld seam, caused by air leaking into the evacuated chamber. Generally, about two feet of seam are tested on each occasion. Leaks are observed through a glass top on the box.

As far as we know, no firm manufacturers vacuum boxes for weld testing. Frequently, however, tank fabricators build relatively simple test chambers similar to the one illustrated here.

The box measures about 10 in. wide and 2 ft. long. Its height varies from 8 in. to 10 in. Any gage material may be used, but the lighter the better. For side walls, $\frac{1}{8}$ in. or 12-gage sheet is preferable.

After welding the $\frac{1}{8}$-in.-thick sheet into a box without top or bottom, weld on some angles to increase box rigidity.

Angle stock should be $\frac{3}{4}$ by $\frac{3}{4}$ by $\frac{1}{8}$ in. Heavier stock may be used, but the recommended sizes are desirable, particularly on the box's lower edge.

To this lower edge—and to the side—weld an angle to form a channel section around the sides. This section adds to bottom rigidity and serves as a retainer for rubber gasket material (the bottom seal).

Effectiveness of the box will depend upon this seal. Gasket material must be resilient to conform with contours of the tank bottom, yet not so porous as to allow outside atmosphere to enter.

Another angle is welded to the tank interior near its upper edge. The angle's edge must project to form a shelf approximately $\frac{3}{8}$ or $\frac{1}{2}$ in. below upper edges of the box.

Exterior angles at the bottom must be continuously welded to form a leak-tight seam, but the interior angle at the top can be tack welded.

The interior shelf seats an observation glass, which should be puttied into place so that it is leak-proof.

Weld three nipples into the box sides. These should be $\frac{1}{2}$-in. iron-pipe size or smaller, and fitted with valves. One connection leads to the intake manifold of an air compressor or engine-drive welder, which will evacuate air from the chamber.

Another nipple will accept a vacuum gage—essential to insure a vacuum being drawn during the test.

The third outlet, fitted only with a valve, breaks the vacuum. After the test has been made, open the valve and allow atmosphere to flow into the box to equalize pressure.

Weld handles to each end of the box. These aid in transporting the unit, and allow the inspector to exert initial pressure on the box before testing.

As outlined above, testing is done by connecting the box to a vacuum source, soaping the seam to be tested, and evacuating all atmosphere.

IMPORTANT ANNOUNCEMENT To Users of Cutting Machines

These widely-renowned oxygen cutting machines feature a distinctive construction and an engineered system of operation. With them, you can now achieve new standards of accuracy in precision workmanship. Write for full details!

NEW SALES MANAGER NAMED

Richard L. Deily has been appointed Sales Manager for Messer Cutting Machines. He is a graduate of Lehigh University. His 20 years' experience in the cutting machine and welding fields includes positions with some of the largest firms in the metal-working industry. May he consult with you on improved cutting techniques?

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Use P&H Low-Hydrogen Electrodes

P&H Low-Hydrogen electrodes give you industry's widest choice of alloys for welding "difficult" steels. There's a chemical analysis to match most parent metals.

Welds are of X-ray quality, with greater ductility at high tensile strength, and better impact properties. For more detailed information, write for Bulletin R-29, Dept. 301B, Harnischfeger Corp., Milwaukee 46, Wisconsin.

HARNISCHFEGER
P&H WELDERS • ELECTRODES POSITIONERS

IAA meet snowed under; weather cuts attendance

In the midst of one of the season's worst snowstorms, the International Acetylene Association's 58th annual convention convened in Philadelphia recently. Only a third of the 500 who reserved seats for the Morehead Medal dinner could make it. Even speaker Dr. A. R. Kinzel and recipient Dr. Robert C. Swain were delayed by the storm.

ABLE to make the meeting were (left to right) past presidents Claude Monlux and J. J. Lincoln, President Easterly and Secretary H. F. Reinhard. The meeting featured technical sessions on acetylene in industrial applications, acetylene in chemical engineering and safety in the use of acetylene.

LEFT to right, Jack Adank, National Cylinder Gas Division, H. A. Sosnin, Tube Turns, E. A. Daniels, Victor Equipment Co. and John Crowe, Air Reduction Sales Co. Sosnin, a welding engineer, spoke on "Oxyacetylene welding of pipe." Other papers on welding included "Oxygen-acetylene flame—its use in construction" and "Hardfacing high pressure steam valves mechanically."

DELIVERING a talk on "The future is still bright" is W. P. Carlin, senior economist, Commercial Research Div., Republic Steel Corp. Technical meetings occupied the first two days, the third was given to association business with reports and election of new officers.

CANADIANS C. McL. Pitts, People's Gas Supply Co. and new IAA president H. S. Sutherland. At the Morehead Medal dinner Pitts, a director and past president of IAA, presented the award to Dr. Robert C. Swain for his work in developing a commercial process for melamine and related derivatives of calcium carbide. →

← IAA president Eugene Easterly, W. P. Carlin, Homer Morrison and President-elect H. S. Sutherland (left to right) at the President's Reception prior to the opening day luncheon. The Bellevue Stratford Hotel was convention headquarters.

MANHATTAN *Reinforced* CUT-OFF WHEELS are Safer!

Engineered *built-in* reinforcement enables a cut-off wheel to take the abuse and excessive strain of heavy cutting in foundry operations. Every Manhattan Reinforced Cut-Off Wheel is reinforced *two* ways, to assure double safe operation on the job. Special fibers in the bond increase the wheel's strength to withstand destruction from centrifugal force by 50%. In addition, special industrial super-strength synthetic reinforcement resists side-strain far beyond the endurance of conventional cut-off wheels. The result? Actual field reports show up to 25% increase in cutting efficiency and cleaning room production . . . on both stationary and swing-frame cut-off machines. At the same time, Manhattan cut-off wheels offer a high degree of safety and protection against breakage.

Ask your Manhattan sales engineer to show you how to get faster, safer cutting and increased production efficiency . . . "More Use per Dollar" . . . with Manhattan Reinforced Cut-Off Wheels and other types of Manhattan high speed, heavy duty wheels.

WRITE TO ABRASIVE WHEEL DEPARTMENT

RM841

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F-101 Supersonic Fighter built by McDonnell Aircraft Co., St. Louis, Missouri

Aluminum dip brazing solves fabrication problem for fighter oil-cooling unit

The plate-type lube oil cooler of the F-101 supersonic fighter must cool the lifeblood of its engine dependably and efficiently in rarified atmospheres. Its design, consisting of a complex perforated grid enclosed in a crimped sheet envelope, demands strength to withstand 400 psi internal oil pressure. *Thousands of tiny grid surfaces had to be joined firmly to the plate envelope with the strength of a single unit.*

A joining problem such as this could only be solved by the aluminum dip-brazing technique. In this instance, Alcoa No. 6061 alloy was joined with Alcoa No. 22 brazing sheet by dipping in molten flux. Result, an all-aluminum unit of high corrosion resistance with strong and uniformly smooth joints.

Aluminum brazing offers many design approaches and advantages worth considering in the planning stage. Complicated assemblies with inaccessible joints can be made as a single unit which is smaller, lighter, more efficient *and* lower in cost. Close tolerances in small parts are obtainable—joints may be built up to desired strength.

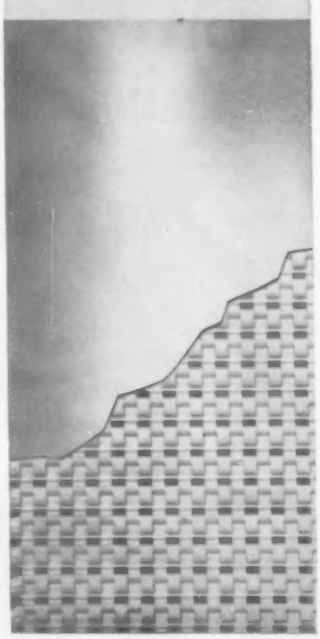
Get in touch with Alcoa *before* you plan. We'll supply the information you need for welding, brazing or soldering aluminum. Contact one of the Alcoa distributors listed at the right or send for free information books and films on joining aluminum. Write to Aluminum Company of America, 1740-E Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
WELDING PRODUCTS
ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE"
Exciting Adventure, Alternate Monday Evenings

Plate-type aircraft lube oil cooler made by Clifford Manufacturing Co., Waltham, Mass., a division of Standard Thomson Corporation. Vertical plates and V-shape dividers or fins provide a heat transfer service of 32½ sq. ft. Oil is cooled by passage of air through these plates.



Cutaway of plate and interior grid through which oil flows.

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

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Saving the unsavable

WHAT IS THE DIFFERENCE between three days and several months?

If you are engaged in something particularly interesting to yourself, the difference may seem little. But if you are in business—the time elapsed could mean a loss of several thousand dollars.

Take the case of Speedway Machine & Tool Co., Indianapolis, one of the Midwest's larger tool and die shops. When one of its vertical lathes shuts down, production falters until the worn or broken part can be repaired.

An integral part of these machines are cast-iron spindles. Heretofore, when a spindle became work-worn, the lathe necessarily was out of production for several months. Now, however, the firm removes the spindle and sends it out to be hardfaced; downtime: just three days.

In charge of hardfacing is Viking Metal Fabricators, Inc., also of Indianapolis. Bearing surfaces—16 in. long with a 14 in. OD on one end and 14 in. long with a 6 in. OD on the other end—are machined to permit laying of the deposit and for finish-machining, which must remove 3/16 in. of metal.

After the spindle has been cut deeply enough for welding, it is preheated to 350 F. A d-c, reverse-polarity, rectifier welder provides 150 amp for welding power.

Two layers of metal are deposited manually on the spindles. Using Ampco electrodes, weldors make the first layer with a 5/32-in. electrode. (E CuAl-2) and the final layer with a 5/32-in. E CuAl-C electrode. This results in a surface hardness of around 200 Brinell.

Last step before replacing the spindle on the lathe is to machine it to original dimensions.

MACHINING a hardfaced spindle

PREVENT UNDERBEAD CRACKING—

use

Airco Easyarc 312

* EASYARC 312 mild steel all-position electrodes avoid underbead cracking.

* Prevent excessive porosity in the welding of cold rolled steels.

* Weld low alloy or mild steel when stress relieving normally would be required, but cannot be effected.

* Weld steels which are to be vitreously enamelled.

* Weld high sulfur free machining steels.

Airco EASYARC 312 electrodes produce weld metal with excellent mechanical properties...Low Hydrogen content... Quiet arc action... Low spatter loss.

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Hardfaced Shovel Dips For Coquina

EONS AGO, in the warm seas off Florida's east-central coast, there lived an almost microscopic shellfish. But as tides rose and ebbed, so did the life-cycle of these mollusks.

As they died, their hard shells became cemented together, forming great reefs of limestone. This we call *coquina*.

When the seas receded, leaving the reefs exposed, early Spanish settlers made use of the dead shells in an area where wood quickly rots.

Coquina, they found, could be turned into wonderful houses: houses that were sturdy, dry and enduring. In fact, many of those pioneer homes still stand, a tribute to America's early settlers.

In our modern, machine-driven, high-gear era, coquina still ranks high as a building material. Now, however, it is a basic ingredient in another form of construction . . . cement. When Lehigh Portland Cement Co. of Bunnell, Fla., mixes silica, alumina, and iron oxide with coquina, it has an inexpensive, dependable product.

Working as it does with knife-sharp shells, the firm expects equipment to wear at an accelerated rate. But it has also learned to expect that

They sell sea shells *from* the sea shore. But without welding maintenance, business wouldn't be so good.

Hardfaced buckets star in underwater mine

the welded application of hardfacing materials will keep it in repair and replacement costs down.

Here's a good example of wear-and-repair: a walking dragline lifting a 20-yd-capacity bucket claws out coquina on a round-the-clock, 365-days-a-year basis.

The dragline must plunge into a man-made lake, grate against the shell as it fills its bucket, pivot and dump the load on huge, already-mined heaps of coquina. The load may also be dropped onto processing ships, where it will be washed over scalping and vibrating screens until all sand is sluiced away.

Wear is obviously tremendous; especially on the bucket's heel plate, bottom ribs, lips, sides and teeth. Of course, Lehigh could choose to ignore it and, after a couple weeks of wear, buy a new bucket. But this would be no answer; at least from the viewpoint of economy.

The solution seemed to be—and is—hardfacing.

By using one bucket until abrasion grinds off its hardfacing shield; then substituting an already hardfaced bucket, Lehigh nurses a month's work from each bucket before it must be re-surfaced.

In this way, production stops only long enough for buckets to be switched, and costs are firmly anchored to rock-bottom.

The impact and abrasion-resistant hardfacing materials are applied by Lehigh with semiautomatic and manual welding equipment.

An Amsco high-chrome tube electrode is used with the semiautomatic welder to coat lip and sides of the bucket.

On the heel plate, which receives the most wear, weldors manually apply a composite contact electrode that has a high carbon, chromium, molybdenum and tungsten alloy content of over 30%.

Lehigh has doubled its Bunnel plant's size since it began cement manufacturing operations in 1952. This success is not due to blind luck; it *can* be traced to hard work *and* the maintenance of existing tools.

If maintenance is vital, can *welding* be far behind?

APPLYING hardfacing material to the bucket's bottom ribs, this weldor helps insure longer life for a vital tool. Job must be done every 30 days because of abrasive, cutting qualities of coquina.

PREST-O-LITE
Trade-Mark
Air-Acetylene Outfits...

Job-Matched to fit your needs

The wide variety of standard PREST-O-LITE outfits available meets almost every soldering, heating, and brazing need. If your job is "out-of-the-ordinary," you can easily make up your own special outfit to meet your exact requirements.

Simply select the torch handle, stems, and accessories you need. Buy *only* what you need, *when* you need it —no "extras." Remember, every PREST-O-LITE stem fits interchangeably on all PREST-O-LITE torch handles. Change-over takes only an instant.

Your local supplier of LINDE products will be glad to help you select a standard PREST-O-LITE outfit that's job-matched to your work—or to help you make up a special assembly for any special need. See him today. If you don't know him already, write: LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y.

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UNION CARBIDE

"Linde" and "Prest-O-Lite" are trade-marks of Union Carbide Corporation.

NEW WELDING PROCESS used to fabricate reactor test vessel

Job Report Courtesy of
Newport News Shipbuilding and Dry Dock Company

the ARCOS EB* WELD INSERT

To simplify and speed joining the halves of this pressure vessel shell, and insure corrosion resistant root passes, a preplaced Arcos Consumable Insert was used. With this method, *only outside welding* was required to produce sound welds with uniform contours on the inaccessible inside surface. The welds readily passed Radiograph inspection for freedom from porosity, slag and other inclusions. The EB Weld Insert can save *you* time and money. Write for details. ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.

*Trademark of General Dynamics Corporation.

Selling ideas in ornamental iron . . . sponsoring annual conventions...Tennessee Fabricating Co. aids industry to a point where

May is now National Ornamental Iron month

IF YOU'VE HAD your eye on a wrought iron fence, porch railing or some iron garden furniture, now is the time to get it—May is National Ornamental Iron month.

Millions of dollars of stock ornamental iron products are sold each year in the United States and even more is spent in custom-built ironwork produced by local iron shops.

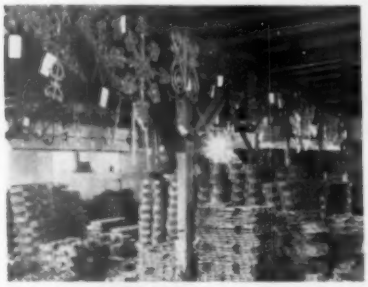
The industry's second annual convention in January this year resulted in formation of the National Ornamental Iron Manufacturer's Association. Purpose of the new trade association is "to further promote the use of ornamental iron as a building and home improvement material."

Both conventions were sponsored by Tennessee Fabricating Co., Memphis, one of the largest manufacturers in the ornamental iron industry.

SCROLL department has two men working full time to keep up with production demands.

Formed almost 13 years ago by its two partners, Abe Sauer and Maurice Fink, the company's biggest job was selling ideas in ornamental iron. Business was strictly local during those first years.

After a "stock" type grille work was developed—standard, adjustable porch columns and rails—business was expanded on a national basis. Introduction of such standardized ironwork afforded building material dealers a chance to carry an ornamental iron inventory. They could



IRON castings in storage warehouse represent 1/10 amount kept in inventory at all times.

now display, promote and give customers immediate delivery.

With acceptance of this age-old building material, iron shops sprang up everywhere, and Tennessee Fabricating expanded again—this time into the raw materials end of the industry.

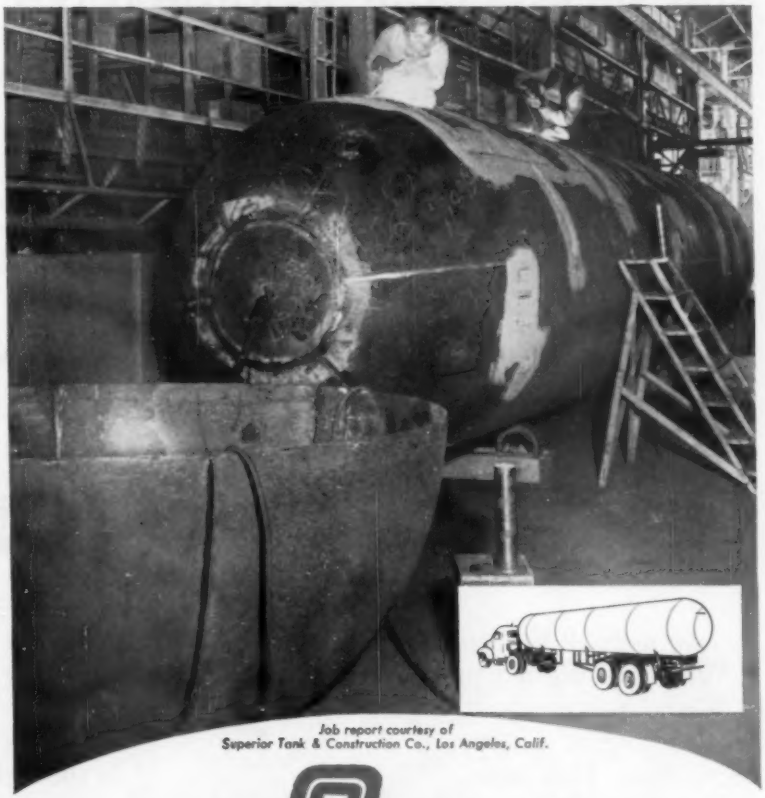
As a supplier to these iron shops, the company now makes decorative cast iron castings, paints, primers, special inexpensive electrodes for welding cast iron to steel, rail fittings and a complete line of steel and square tubing.

Related items, such as iron garden furniture, house markers and weather vanes, are manufactured for iron customers. Helping customers by means of other services is also an important factor. Fabricator customers are offered catalogs, literature, newspaper mats and all types of modern selling aids.

The company's plant covers 150,000 sq ft of working and storage space which includes four large quonset-type buildings and three warehouses.

Since ornamental iron is used in greater volume as a home-improvement material than as a new-home building product, the industry's future seems limitless.

How X-Ray Quality Welds Make Low Alloy Steels Pay Off



Job report courtesy of
Superior Tank & Construction Co., Los Angeles, Calif.

WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The vessel being welded is part of an L.P.G. tank truck. For high strength with low weight—USS "T-1" steel is used and welded with Arcos Ductilend 110 Electrodes. These tanks meet or exceed ASME code requirements . . . and all Ductilend 110 welds qualify with X-ray soundness. Ductilend 110 is an Arcos Low Hydrogen Electrode especially developed for welding high strength notch tough steels of the 110,000 psi tensile strength range. Data sheet on request. ARCOS CORPORATION • 1500 South 50th Street, Philadelphia 43, Pa.

When Grandma put down her knitting and picked up a welding torch . . .

. . . we were all flabbergasted.

Why? we wanted to know.

Without interrupting a perfect bead, she nodded toward a copy of *Welding Engineer's* FACT FILE issue.

"I just couldn't resist the ads," she trilled through her weldor's mask.

We may be joshing some—about Grandma's welding, that is. But we are very much in earnest when we offer you a bargain of an advertising buy.

The Mid-June FACT FILE 1) is permanent 2) includes all *Welding Engineer* and *The Welding Distributor* readers, upping circulation an extra 5,000, and 3) is well read—we know, because we were asked for 6,200 reprints from last year's issue.

Judging from letters we get after the FACT FILE is published each June, this directory has become something of an institution in the welding industry. Some praise its data sheets which cover on-the-job problems, others particularly favor the product listings.

In the weld world, our FACT FILE's listing of manufacturer's names and addresses makes it as handy as the phone book. What's more, any top *WE* article of 1957-58 can be easily pinpointed by using the directory's bibliography.

And your year-long ad in this year's FACT FILE costs no more than a regular *Welding Engineer* ad.

Closing date is May 20—just a couple of weeks away—so you still have time to get in. Your customers won't be without our directory. How can you afford not to be in it?

. . . Grandpa put away his whittling, and picked up The Welding Encyclopedia

"Can't let Ma get ahead of me," he explained.

"So I took myself to the library and asked for the best reference book on welding, and this is what they gave me," he continued, waving THE WELDING ENCYCLOPEDIA at us.

"The librarian said this book is used all over the world as a guide to welding. By reading it, I can explain to Ma what she's been doing," he chuckled.

Grandpa has just discovered what most people in the welding business already know —that THE WELDING ENCYCLOPEDIA is the most trusted guide for welding information.

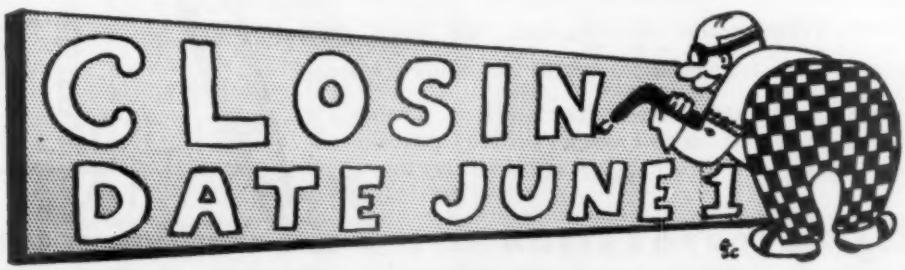
The 14th edition of the Encyclopedia is in the making, and advertising space is again available.

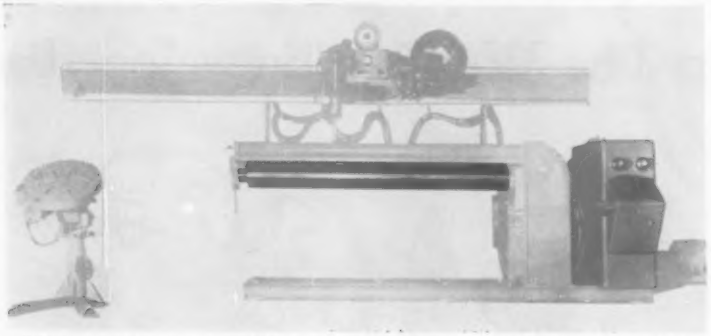
The new edition is being revamped to cover the great strides made by the welding industry in the past few years. Now is your chance to be a part of the new WELDING ENCYCLOPEDIA.

A welding industry exclusive is a dictionary of trade names—the only complete compilation available.

In catalog fashion, a welding industry buyer's guide is offered in the book, advising where to get the latest in welding equipment, supplies and accessories.

THE WELDING ENCYCLOPEDIA is the welding industry's most respected and valuable reference. You will want to be included in its information-filled pages. Closing date for ads is June 1.





FOR pre-weld and post-weld heating of crack-sensitive metals, interchangeable, temperature-controlled mandrels are available. (See story)

THIS small Mig gun is for short-length welds in hard-to-get-at places. (See story)

Mandrels

FOR longitudinal and circumferential welding machines, a line of interchangeable temperature-controlled mandrels for pre-and post-weld heating of crack-sensitive metals is available. The new system features thermostatically-controlled, electrical immersion, remote heating unit in which special oils may be heated from 80 to 600 F with a variation of only 15 F. The oil is circulated, under pressure, through the welding backup mandrel and returned for reheating. Heat from the oil is transferred, by conduction, to the steel mandrel and copper or steel backup bar. *Airline Welding and Engineering Corp.*

Circle No. 1

Hand gun

CONTINUOUS wire feed from a spool in the gun is possible at speeds up to 900 ipm with this "MIGet" hand gun. It is especially good for reaching hard-to-get-at places. Total weight of gun, with 1 lb wire spool, is only 4½ lb. The gun handles .030, .035, 3/64 and 1/16 in. aluminum and .030, .035, .045 in. hard wires. Typical applications include: extruded aluminum shapes, highway signs, aluminum furniture, radar screens and antenna, and brackets and pads attached to ship superstructures.

Cabinet is 11 in. wide, 12 in. long and 4 in. deep, and weighs 17 lb. Gun measures 14½ in. from front to rear, 7⅞ in. high and 5¼ in. at widest part. Weighs about 3 lb and power source must be a d-c machine. *Air Reduction Sales Co.*

Circle No. 2

Tempilstik°

FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon... marks like a crayon... tells temperatures like a precision instrument!

Available in these Temperatures (F.)

113	375	1000
125	388	1050
138	400	1100
150	413	1150
163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	525	1550
263	550	1600
275	600	1650
288	650	1700
300	700	1750
313	750	1800
325	800	1850
338	850	1900
350	900	1950
363	950	2000

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F.

TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM . . . WRITE "WELDING SALES" DEPT. FOR SAMPLE TEMPIL° PELLETS . . . STATE TEMPERATURES OF INTEREST—PLEASE!

Tempil° CORPORATION 132 WEST 22ND STREET, NEW YORK 11, N. Y.

CO_2 GAS SHIELDED WELDING

ON WELDING GAS COSTS

CO_2 Metal Arc Gas Shielded Welding costs approximately 1½¢ *per cubic foot of gas!* Even on a limited budget, you can afford shielded gas welding.

How satisfactory is this method? Many satisfied users indicate that the MAGS process produces welds that are equal, *or superior*, to more costly argon or helium welds. This is due to the agitating type of arc, characteristic of CO_2 welding.

How CO_2 Will Benefit You

- Saves over 6¢ on every cubic foot of gas used
- Greater penetration
- Increases metal deposition rate
- Less reworking required
- Increases operator flexibility
- Better appearance

Red Diamond Welding Grade CO_2 is available from all nearby Liquid Carbonic depots.

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DURO

The Standard

The NEW DUROGON

The Standard DURO Holder

Standard

Perfect Balance • Easy Replacement of Parts • The Long Jaw makes the hard to get at places easily accessible. After 26 years of proven performance these features make the DURO Standard still the Preferred Holder.

DURO'S NEW Holder The Durogon

Model N3
Model N3HD

Model N3 New alloy, high tensile strength, light-weight aluminum body.
Long Life Copper Alloy renewable jaws.
Extremely cool operation. Fully insulated.
Jaw Insulation resists high temperature.
All parts quickly replaced using only a screwdriver.
Rugged Heavy-Wall Fibre Grip.
Solderless Type, proven cable connection.

Model N3HD Recommended for Heavy Duty continuous service.
All the features of the Aluminum model Durogon, but this body is made of rugged high conductivity bronze for super conductivity and choice of mechanical, soldered or brazed cable connection.
In addition, this heavy duty model has an extra long, heavy-wall fibre grip.

Write for literature and name of nearest distributor.

DURO ENGINEERING COMPANY
51 OREGON AVE HAMDEN CONN

Bright wire

FOR Mig welding, a new type bright welding wire has superior quality surface, manufacturer says. Available in broad range of alloys, the wire is expected to improve quality and consistency of aluminum welding.

Wire is available in 1 and 10 lb spools in diameters from .020 to ⅛ in. Welding wire is being produced in 1100, 4043, 5154, 5254, 5052, 5652 and 5356 alloys.

Electrodes for Tig welding are available in 36-in. straight lengths in the same alloys as spooled wire, diameters ranging from 1/16 to ¼ in.

Another new item is a 5183 alloy welding wire, also with a bright surface, which meets the ultra-high strength welding requirements of the firm's 5083 alloy sheet and plate. It is virtually a general utility filler material for welding the whole family of high strength magnesium bearing aluminum alloys including 5154, 5086, 5083 and 5456, *Kaiser Aluminum & Chemical Sales, Inc.*

Circle No. 3

Weld screw

NEW concept in projection weld fasteners is called "Rimguard" weld screw. To fasten projection-welded assemblies, the screw features a strong protective rim around the periphery of the screw head and four weld projections. The rim limits amount of pressure that may be applied to projections during the fusing stage, so weld metal is properly diffused and also confined. This minimizes spatter and flash, manufacturer says, and the possibility of burning and discoloration is greatly reduced.

Both type screws are made in diameters from No. 6-32 to No. ⅜ in.-16 and are carried in lengths from ¼ to 2 in. *Parker-Kalon Div., General American Transportation Corp.*

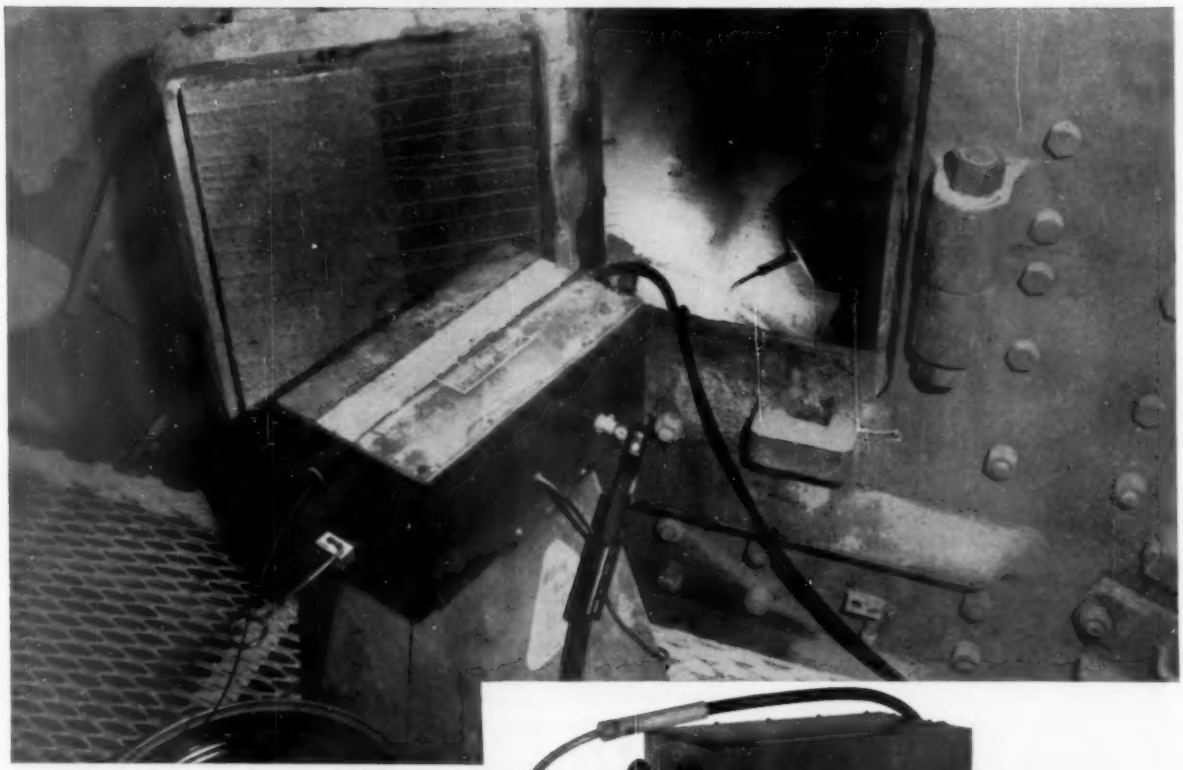
Circle No. 4

Brazing alloy

HIGH-tensile nickel silver brazing alloy is available in five diameters bare (1/16 to ¼ in.) and four diameters with flux coating (3/32 to ¼ in.). Rod is recommended for fabrication of small parts and the repair of machine tools. Alloy "111" produces a corrosion resistant weld deposit. Specifications are: melting point, 1,700 F; Brinnell, 160-170; tensile strength, 80,000 psi; shear strength, from 150,000 psi; AWS classification, BCuZn-6. *American Brazing Alloys Co.*

Circle No. 5

"Saved 50% on Crusher Maintenance with WEAR-O-MATIC wire feed unit and wires."



U. S. Patent applied for.

"We've had our Wear-O-Matic Wire Feed Unit for three months and we'll cut hard surfacing maintenance time on our 5360 and 4350 Cedar Rapids crushers by at least 50%. For the first time it looks as though our weldor will be able to do the right kind of a job on these crushers with enough time left over to do an adequate job on the shovels and other equipment."

"In addition to a savings in time, we find that Wear-O-Matic wire deposits wear longer than the deposits of stick electrodes we have used. Also, our weldor likes to work with your machine and Payoffpak wires . . . it's the easiest to set up that he has ever used."

Maintenance Superintendent
Lincoln Stone Inc., Thomasville, Penna.

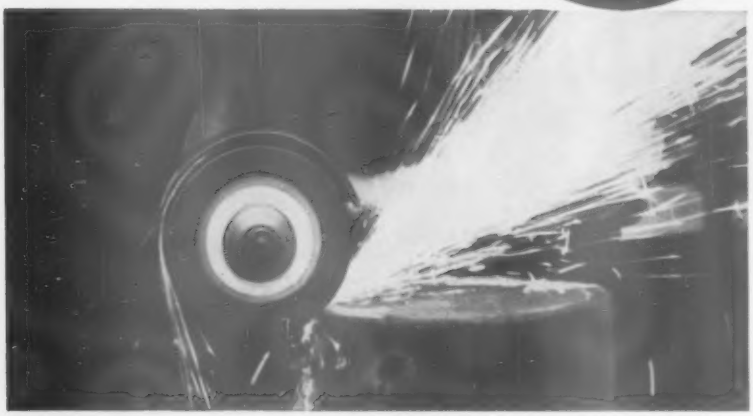
The customer has told only part of our story . . . may we add—The Wear-O-Matic wire feed unit sells for only $279.00 f.o.b. York, Pa. or El Segundo, Calif. For complete details write requesting Bulletin HS-102: Alloy Rods Company, P. O. Box 1828, York 2, Penna.

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

ATLANTIC WHEELS

cut work fatigue to a man-saving minimum!



Ask the men who use them — Atlantic Grinding Wheels have a smooth, floating action that requires less grinding pressure, keeps operators fresher for longer periods throughout the daily work schedule. Even where metal removal is roughest, you can count on Atlantic Wheels for fast, cool, clean-cutting performance . . . depend on their rugged resinoid bond for maximum on-the-job safety.

A trial run in your plant will quickly prove their worth in money-saving terms. Have an Atlantic representative recommend the right wheel for your specific requirements. Meanwhile, write for your free copy of the Atlantic Grinding Wheel Catalog. Atlantic Abrasive Corp., 540 Pearl Street, South Braintree, Massachusetts.

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POSITION_____

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Heating units

FULL line of induction heating units is available in three frequency ranges: low, 7½-1,750 kw, 1-10 kc, motor generator powered; medium, 3-50 kw, 450 kc, electronic generator equipped; and high, ¾-20 kw, 27.1 mc, electronic generator equipped.

Unit offers precision heat control for applications in heat treat, hardening, billet pre-heating, ingot breakdown and a variety of joining operations, including brazing and soldering. *Robotron Corp.*

Circle No. 6

Valve control

REMOTE or automatic control for valves, variable speed drives and other machinery is possible with a new control, the "Metertrol," when used with a shaft mounted gearmotor. It may be used with any other positioning device which incorporates or drives a potentiometer. *Jordan Co., Inc.*

Circle No. 7

X-ray film

EXPOSURE time in radiographic inspection of thick sections will be cut with a new industrial X-ray film, said to be 50% faster than film now in use. Radiographic sensitivity compares favorably, firm says. *Eastman Kodak Co.*

Circle No. 8

Round clamp

WELDING problems are being solved with a new type of hose clamp, its manufacturer says. The O-shaped, one-piece clamp can be used without special tools, is compact and holding strength exceeds hose bursting pressures. Clamps have been used on cooling water and shielding gas lines in spot welding gun, and on exposed positions on portable welding guns to reach hard-to-get-at places. *Circle Clamp Corp.*

Circle No. 9

SR . . . the dc rectifier type welder with new completely sealed semimetallic rectifier, new transformer and new weld stabilized circuit. Result is easiest arc starting ever, maximum arc stability; sounder, denser welds; current that handles all electrodes in all positions! Four models, 200 to 600 amps.

SRH . . . the same revolutionary improvements that set the Gold Star SR above and beyond the performance standards ever before achieved by a dc rectifier type welder. Designed primarily for compactness, the SRH is only 30¼" high — is ideally suited for stacking or paralleling in minimum space. Three models, 200 to 400 amps.

The miller GOLD STAR ALL STAR LINE

300 . . . combination ac/dc welder design comes of age with this new Miller model. Features: new magnetic amplifier circuit; improved wave form; new arc starting control; three electrically controlled current ranges for finest adjustment; instant change-over from ac to dc; built-in high frequency. An entirely fresh concept for inert gas and metallic welding. Four basic models with kits available to convert to seven different types of welders.

300-M . . . an ac welder for inert gas and metallic arc processes. Combines unequalled welding characteristics with Miller's unique electric control circuit which permits precise slow or fast start. Features: built-in high frequency, primary contactor and ½ KVA control transformer. Offered in three basic models of from 200 to 400 amperes with optional water and gas controls available.

Complete particulars on any of the above welders will be sent promptly.

miller ELECTRIC MANUFACTURING COMPANY, INC. Appleton, Wisconsin

Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal, P. Q.

NOW, A MANGANESE STEEL ELECTRODE

with High Build-up, Low-spatter, Easy Slag Removal

A special new Amsco rod, Nicro-Mang, for both joining and buildup of manganese steel

Out of Amsco® metallurgical research has come a new welding rod that gives you high weld strength without cracking on Austenitic manganese steel. A rod that lets you lay down a bead without slag popping, and slag removal is easy.

To lick the cracking problem, it took a special alloy of chromium and nickel, plus a unique coating for Nicro-Mang.

Write for Nicro-Mang bulletin, or see your local Amsco distributor.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Illinois

Powder lance

METAL or concrete of any thickness can be pierced and cut through with a new "ACL-3" powder lance. Accurate control of intense heat is the key to operating the lance, explains the manufacturer. Lengths of standard black iron pipe are fitted into the front end of the lance, which is connected to an oxygen supply and a source of special metallic powder. The oxygen and powder are mixed in the pipe and carried to the material being pierced or cut by the consumable pipe. On materials such as concrete, aluminum powder is added to the metallic to intensify the cutting reaction.

The ACL-3 is valuable on jobs where blasting cannot be used, the firm says. "Anyone familiar with oxyacetylene welding and cutting apparatus will have no trouble getting the feel of the ACL-3." Each lance comes with a repair kit. *Linde Co.*

Circle No. 10

Turning roll

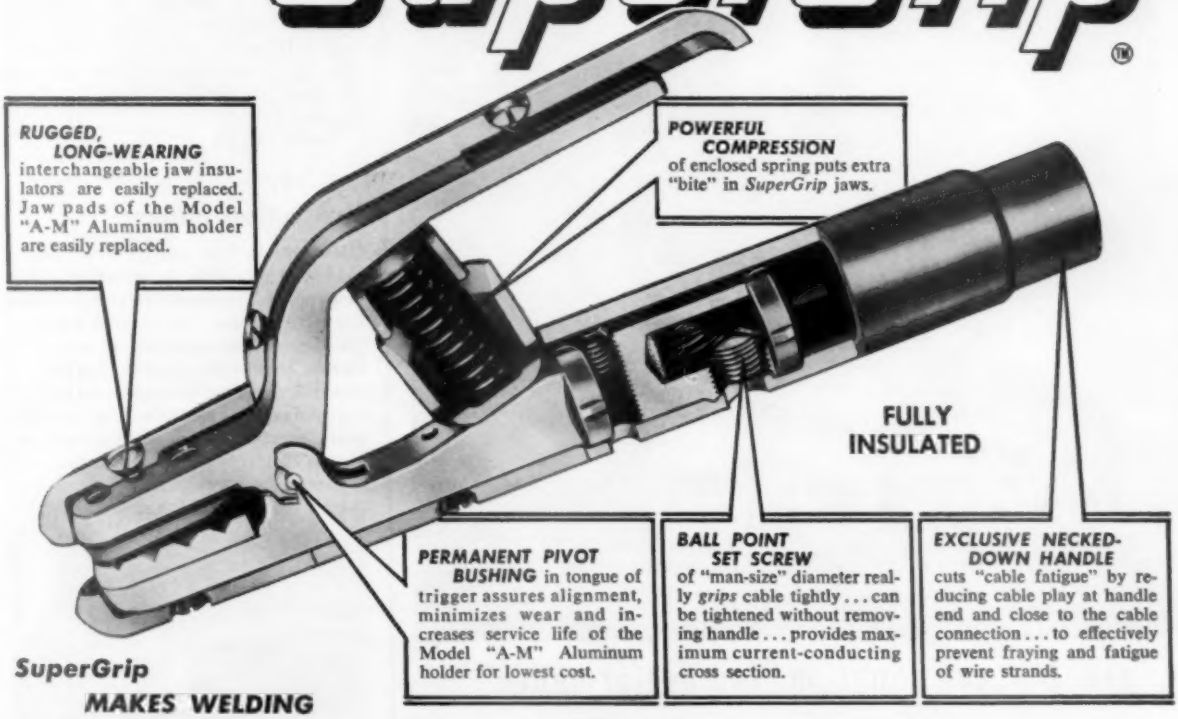
DESIGNED to handle oddly shaped vessels, a new turning roll is 36 in. in diameter, 6-in. face, has a 2-in. thick forged and flame-hardened ring. The small width and large diameter of the wheel provides clearance for vessels with limited roller access due to large or closely spaced projections. Power is provided by an electronic variable speed drive accommodating loads up to 50 tons. *Worthington Corp.*

Circle No. 11

"...it's continuous **COOL** man!"

you get more work out of the NEW, high-efficiency...

SuperGrip®

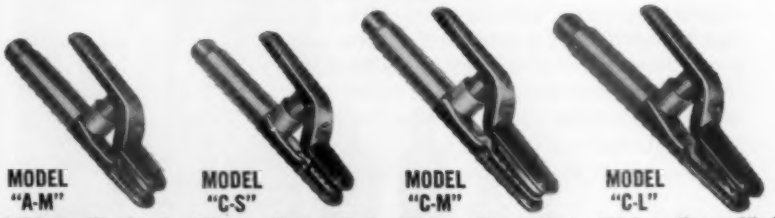

RUGGED, LONG-WEARING interchangeable jaw insulators are easily replaced. Jaw pads of the Model "A-M" Aluminum holder are easily replaced.
POWERFUL COMPRESSION of enclosed spring puts extra "bite" in SuperGrip jaws.
FULLY INSULATED
PERMANENT PIVOT BUSHING in tongue of trigger assures alignment, minimizes wear and increases service life of the Model "A-M" Aluminum holder for lowest cost.
BALL POINT SET SCREW of "man-size" diameter really grips cable tightly... can be tightened without removing handle... provides maximum current-conducting cross section.
EXCLUSIVE NECKED-DOWN HANDLE cuts "cable fatigue" by reducing cable play at handle end and close to the cable connection... to effectively prevent fraying and fatigue of wire strands.

SuperGrip MAKES WELDING SAFER, EASIER, MORE ECONOMICAL!

It's the most! Not just continuously cool... *SuperGrip* is the Welding Electrode Holder designed to eliminate not just one or two, *but* EVERY awkward, irritating, troublesome design point ever built into an ordinary holder! No more frayed cables! ***No more over-heated holders! Now you get the neat, compact design that increases maneuverability and minimizes work fatigue!***

At every vital point... bushed pivot pin, long-wearing jaw surfaces, powerful spring, securely anchored cable, reduced cable play... *SuperGrip* approaches the ultimate in holder design. ***Ask your Welding Distributor for a SuperGrip TODAY!***

There are 4 light, compact, rugged SuperGrip models:



MODEL "A-M" — 300 Amps. (Aluminum) for ¼" Weld Rod

MODEL "C-S" — 250 Amps. (Copper Alloy) for 5/32" Weld Rod

MODEL "C-M" — 300 Amps. (Copper Alloy) for ¼" Weld Rod

MODEL "C-L" — 500 Amps. (Copper Alloy) for ⅜" Weld Rod

Sold Everywhere thru leading Distributors and Dealers. *Ask for Bulletin 65*

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"...top performance..."

with Norris-Thermador ACETYLENE CYLINDERS

The Burdett Oxygen Co.

"We have had thousands of Norris-Thermador Acetylene Cylinders in constant use for more than ten years and they have always given us top performance."

W. H. Loveman

W. H. Loveman, President
The Burdett Oxygen Company

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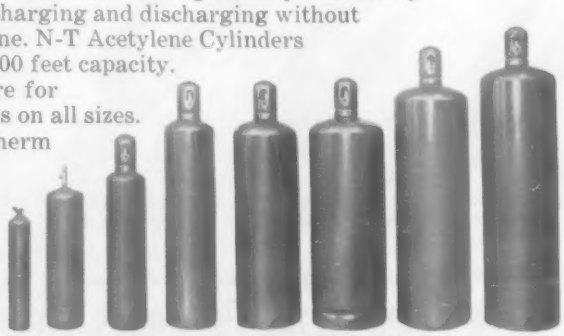
you, too, can count on "top performance"

with Norris-Thermador Acetylene Cylinders. They cut time and build profits by performing at peak efficiency. Norris-Thermador monolithic filler is compounded with laboratory precision for maximum strength and permeability. Their thick, rugged shell construction means longer life, and their high filler permeability means fast charging and discharging without loss of acetone. N-T Acetylene Cylinders from 10 to 300 feet capacity. Write or wire for specifications on all sizes.
Cable: Northerm



"SEVEN LEAGUES AHEAD IN THE SCIENCE OF ACETYLENE CYLINDERS"

NORRIS-THERMADOR CORPORATION

5215 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA

Flux screen

SUBMERGED arc welding flux screen has smooth action with little vibration transmitted to the frame. The 10 by 32 in. screen can handle most loads, manufacturer explains. Screen is fed from hopper mounted under the weldment assembly. As flux is fed to weldment, spilled and fused flux, scrap and welding rod tips feed to the screen. The spilled flux is screened and carried by the pan below to a bucket elevator which travels back to the flux feeder. Other material is carried off the screen deck and discharged to a reclaim or scrap box (where it can get to a flux reclaiming unit.) If bucket elevator is not used, flux can be discharged to tote box and emptied into feeder. *Simplicity Engineering Co.*

Circle No. 12

Projection paper

PHOTOGRAPHIC projection paper makes it possible to produce high-contrast enlargements from microfilm negatives, firm announces. Called "Kodagraph Projection paper, translucent," the new paper is expected to expedite retrieval of engineering drawing reproduced on microfilm. *Graphic Reproduction Sales Div., Eastman Kodak Co.*

Circle No. 13

Paint cage

PAINTING small parts (washers, clips, spacers, etc.) used to take 3 hours—now it takes 3½ minutes. By putting scrap parts together, this aircraft company came up with the "pronto painter," a revolving wire-cage drum into which the parts are loaded. An air blast keeps parts from sticking together while extremely fast-drying paint is sprayed on, and parts are smooth and dry when removed from the tumbler 3 minutes later. *Boeing Airplane Co.*

Circle No. 14

Work gloves

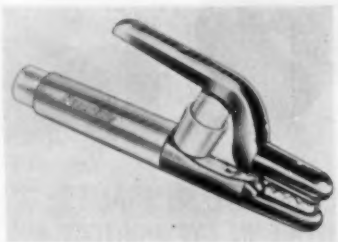
LINE of work gloves offers neoprene, vinyl plastic and rubber coated protection. Neoprene gloves are liquid-proof; acid, solvent and caustic resistant, and are recommended when heat, snagging and cutting are a danger. Vinyl plastic gloves are effective against oil, resist solvents and abrasives. The rubber-coated group offers resistance to cutting, abrasions, heat and punctures. *Riegel Textile Corp.*

Circle No. 15

Plastic metal

SOFT, putty-like material "Plastic metal" can be applied with putty knife to anything cracked, chipped, gouged, etc. At average room temperature of 70 F, it hardens to the consistency of solid steel within 30 minutes, manufacturer says. Then it can be drilled, threaded, machined, etc. Material bonds with iron, brass, aluminum, bronze, etc. Regardless of temperature, plastic adheres permanently. *A. L. Okun Co., Inc.*

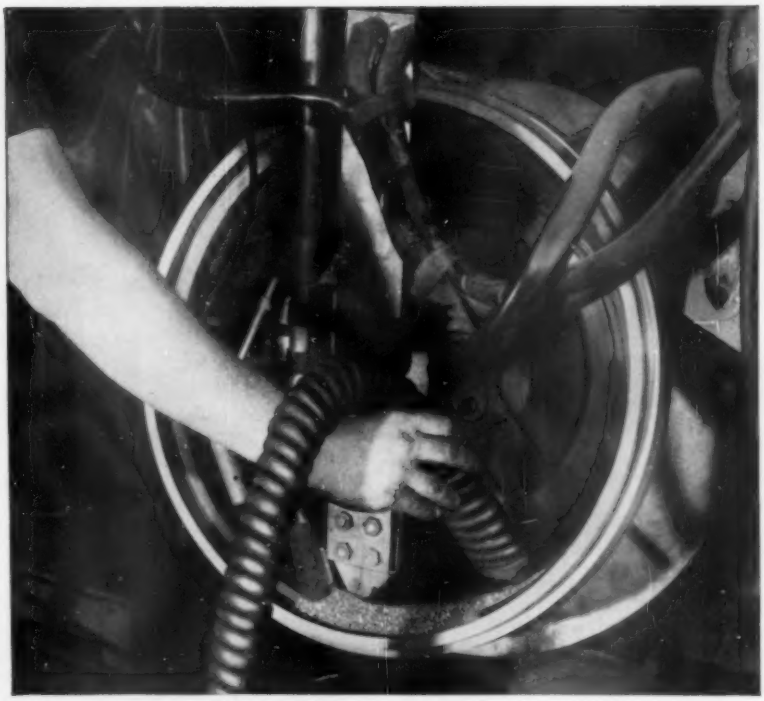
Circle No. 16



Electrode holders

THREE copper alloy and one aluminum model electrode holder comprise a new line. A reduced-diameter handle end prevents stress and wear of the cable, and a large diameter ball-point set screw gives a broad connection between the holder and cable for maximum current density and capacity. Jaw pads of the aluminum holder are copper-alloy and are replaceable. It has a capacity of 300 amp, maximum electrode diameter is ¼ in. Model C-s, 250 amp, 7/32 in.; Model C-m, 300 amp, ¼ in.; Model C-6, 500 amp, ⅜ in. *Fibre-Metal Product Co.*

Circle No. 17



INVINCIBLE

Welding Flux Recovery Units Quickly Pay for Themselves!

The American Welding and Manufacturing Company, Warren, Ohio, has used Invincible units for several years along with their submerged arc welders. They report that:

1. The Invincibles recover *all* the unfused flux for re-use.
2. The quality of recovered flux is high for Invincibles return only slag-free, usable material to the hopper of the welder.
3. The operator removes unfused flux from area of weld so he can concentrate entirely on his work.

Model 490 designed especially for use with portable welding equipment.

Two machines used by this manufacturer salvage about 100 lbs. of material daily. So, within a few months the value of the flux recovered was equal to the price of the Invincibles. Since then, they have made important savings while giving trouble-free service.

WRITE FOR FOLDER on all types of Flux Recovery Systems.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

ANY Pipe Joint or Structural Angle Cut NOW Layed Out in Just MINUTES!

- Marks off easily and accurately any pipe joint.
- Eliminates all figuring of cut backs, and marks all around pipe.
- Saves man-hours, as well as oxygen and acetylene gas.
- Makes it easy to mark off end of lateral pipe.

NO MISTAKES — NO TIME LOSS

—regardless of the type or size of pipe joint to be welded. No more "cut and try" with a CONTOUR MARKER — it eliminates the need for calculation, and is available in 2 sizes for marking pipe and structurals of 1½" to 18" in cross section, and from 16" to 48" diameter. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgrs. of Boyce Centering Heads, Radius Markers and Pipe Flange Aligners.

THE CONTOUR MARKER

Water saver

OVERCOOLING and condensation are eliminated with a new "SP" series "Water Mizer," which can be used on large projection welders, air compressors and multi-gun multi-transformer welders. Manufacturer reports a 90% savings with the new automatic control. *Van Vooren Products*
Circle No. 18

Thermometer

WITH head diameter of 1-11/16 in., new thermometer is suited for installation on any type equipment where mounting space is limited, manufacturer says. "Model G" is built on direct drive bi-metal coil principal, which eliminates gears and linkage. Except for dial, thermometer is all stainless steel. It is moisture sealed, overheat protected, pressure proof and individually calibrated for peak accuracy. Available in 11 ranges, thermometer can be supplied with stem length as short as 2½ in., or long as 72 in. *W. C. Dillon & Co., Inc.*
Circle No. 19

Goggles

"LIKE a second skin," firm says about its new goggles. Made of soft vinyl plastic frames, the goggles fit close to the face. Model GW-400, for weldors, has light-proof indirect ventilators. They are fitted with removable rings and filter lenses. Goggles have pliable nose shields. *Glendale Optical Co., Inc.*
Circle No. 20

Drill press vise

ALL types of drill press work can be done with new "X4V" vise. Main body and jaw is machined from gray iron. The handle swivels away from work. Width of jaws is 4 in., depth, 2 in., opening, 7 in. Base size overall is 6¼ by 11⅛ in., net weight is 18¼ lb. *Alva Allen Industries.*
Circle No. 21

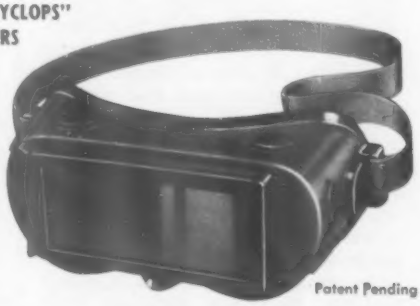
SO LIGHT . . . SO SOFT
THEY NEVER
TAKE THEM OFF!

Patent Pending

STYLE 5050—WELSH "SOFT-I" COVER GOGGLES FOR WELDERS

SOFT, LIGHT, PLIABLE WELSH FRAMES
PROVIDE NEW COMFORT IN EYE PROTECTION

STYLE 5070—WELSH "CYCLOPS" EYE SHIELDS FOR WELDERS with simplified lens holder.



Patent Pending

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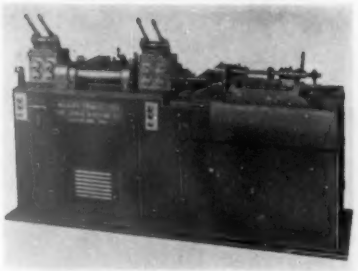


Wire straightener

FOR high-speed cutting of welding rod, a new "FH" high-speed series of "Flying-Shear Wire Straightening and Cutting" machines have a capacity in mild steel of $\frac{3}{32}$ to $\frac{1}{4}$ in. diameter. In high carbon, alloy and stainless—$\frac{3}{16}$ in. maximum. Feed speeds reach from 75 to 520 ft per minute. With an air clutch, synchronization of the cut-off and wire speeds and maximum accuracy is attained in the range of 125 to 395 ipm. Without the clutch, even higher rates of automatic production of welding rod is possible. *Lewis Machine Co.*

Circle No. 22

Test kit

FIELD testing of portable combustible gas indicators can be done with a new kit. A known percentage mixture of methane and air checks the reading on gas indicator's meter. To make a test, an ampoule of methane is broken inside a plastic squeeze bottle, and the mixture is fed into the indicator. Methane's critical response properties make it ideal for such a test. *Johnson-Williams, Inc.*

Circle No. 23

Temperature indicators

WHEN temperatures of welding operations must be determined, two new temperature indicating crayons for 2,050 F and 2,100 F can do the job. *Tempil Corp.*

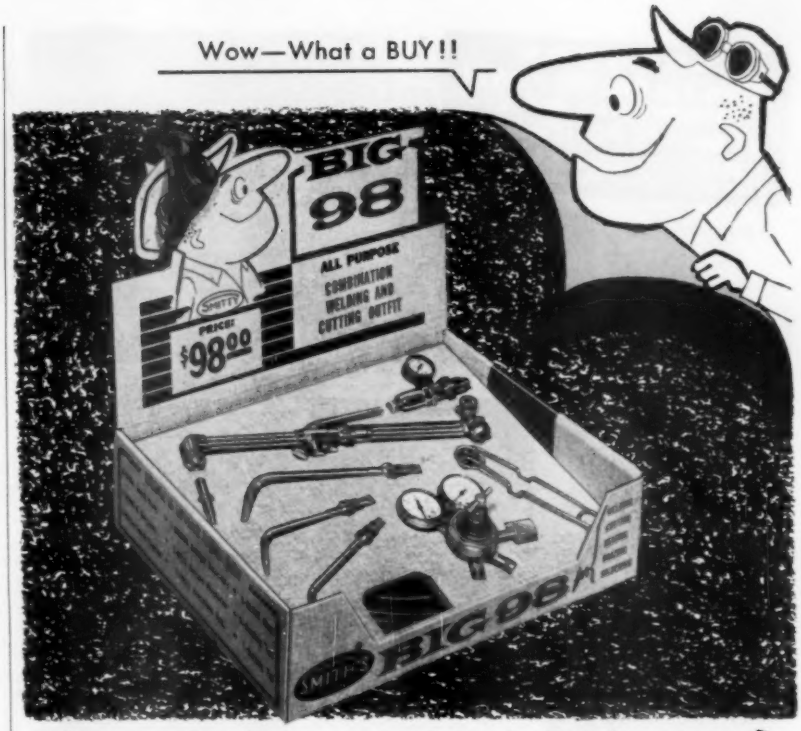
Circle No. 24

Weld Outfit

PACKAGED welding outfit, the "Redi-Set" is portable, yet does heavy jobs. The unit is especially good for occasional welding and cutting jobs, as well as industrial plants, pipeliners, construction, utility and service firms, manufacturer says.

All equipment for welding, cutting, brazing, soldering and heating is included in the 12 lb unit, which cuts up to 14 in. armor plate. In medium and light-duty models, set includes operating instructions and pressure charts. *K-G Equipment Co.*

Circle No. 25



Never before at this LOW price!

Smith's new "Big 98" for $98

All purpose combination WELDING CUTTING outfit

DOES MULTIPLE JOBS . . . welds, burns, heats, brazes, solders and treats your pocketbook kindly—the best buy of the year! Welding range, with 3 tips supplied, is 1/32" to 3/8", but nine other tips increase welding capacity to 7/8". With the cutting assembly and tip furnished, you can burn steel from 1/8" to 1" in thickness (other tips increase cutting range to 4")—*clean, high speed cuts with minimum gas consumption.*

SLIP-IN TIPS make operation easier and faster. Tighten with finger pressure only—no wrench needed. Special-purpose tips (send for free Smith's catalog) adapt this torch to scarfing, rivet washing and gouging. All Smith's tips have recessed, damage-proof seats. Exclusive "Flo-Trol" diaphragm stops causes of backfires—eliminates seat burn-out by preventing reverse flow of acetylene: protects torch against premixing of gases—reduces downtime.

Just introduced! New AIR-LP GAS TORCH KIT. Ideal for soldering, light brazing, leading, thawing, general heating—many more jobs. Write for Bulletin HHP-1.

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SMITH WELDING EQUIPMENT CORPORATION

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One of Americas pioneer manufacturers of equipment for welding, cutting, heating.
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ARONSON
Offers You Over 200 PROVEN Standard Stock Models of Quality POSITIONERS "POSITIONEERED" to your exact Requirements

Patented

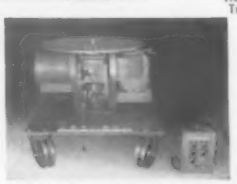
Aronson TracTred (T. M. Reg.) Turning Rolls for thin-walled heavy cylindrical work to 27 tons capacity. Zero to 100 IPM turning speed and Built-In Grounding.

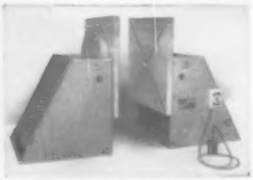
Aronson Universal Balance Positioners (T. M. Reg.) position your weldments effectively, instantly for downhand welding. Capacities to 2000 lbs.

Patented

Heavy Duty Precision Built Rubber and Steel Tired Turning and Pipe Rolls, 100% overload protected. Capacities to 600 Tons.

Fully Automatic Gear Driven Positioners, featuring Geared Elevation, 135° Tilting and Variable or Constant Speed Rotation. Capacities to 350,000 lbs.


Model D Gear Driven Positioners. Compact. Precise. Rugged. Capacities to 1000 lbs.


Rugged Head and Tail Stock for positioning bulky weldments between centers. Table Backup for Zero Deflection. Magnetic Braking. Capacities to 160,000 lbs. Geared Elevation Optional.

Heavy Duty Floor Turntables with precision speed control and Magnetic Braking, used for welding, burning, X-raying, etc. Capacities to 120,000 lbs., various heights and speeds.

Bench Turntable Automatic Positioners with Mercury Grounding. Capacities to 500 lbs.

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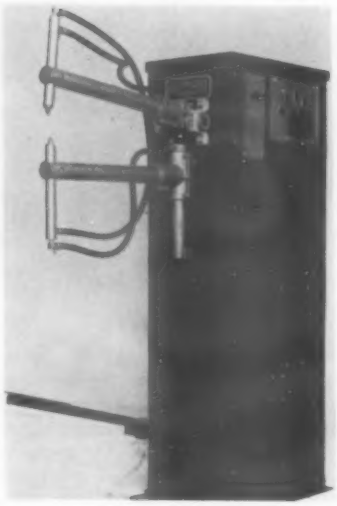

Spot welder

HEAVY-duty industrial spot welder features an adjustable lower arm. It is foot operated and reversible double end horns permit corner welding. The spot welder heat control switch is designed for very heavy work, manufacturer says. *Birdsell Mfg. Co., Inc.*

Circle No. 26

Overload device

SAFETY overload device protects high speed presses and dies against misfeed or doubling of material. It will not permit more than two thicknesses of material to enter the die at the same time, manufacturer states. *Precision Welder & Flexopress Corp.*

Circle No. 27

Turning rolls

DESIGNED especially for rotating small diameter pipe, a new series of power and idler turning rolls are available in two models for small and medium diameter range. Model 3 rotates pipe from 3½ to 36 in. OD and model 10 rotates pipe from 10 to 60 in. OD. Diameter range for each model is with fixed wheel spacing. Welding speed for each is 6 to 60 ipm, the power roll has a turning capacity of 6,000 lb and 6,000 lb weight capacity when used with two idler roll stands, or 4,000 lb weight capacity with one idler stand. *Pandjiris Weldment Co.*

Circle No. 28

produced in making tin cans. This year, Metal & Thermit Corp., the firm which evolved from Goldschmidt Detinning Co., is marking its 50th anniversary.

The original Carteret, N. J., detinning plant is still in operation and, with four others, produces some 350,000 tons of tin plate scrap each year. The firm has branched out into the chemical field, and is in such fields as metals, mining, electroplating, and arc welding. It is one of the country's largest suppliers of arc welding electrodes, machines and supplies.

Sales potential of M&T will be increased by one-third with the opening of a recently dedicated organometallic chemical manufacturing plant in Carrollton, Ky., H. E. Martin, president, reports. The firm plans to transfer organic production from Rahway, N. J. to the Carrollton facilities.

Edin merges with Epsco

Edin Co. of Worcester, Mass., will soon merge with Epsco, Inc., Boston. The Worcester firm will operate as a division of Epsco, and plans call for its facilities to be increased. Murray W. Edinburgh has been elected to the board of directors of Epsco, and will be vice president, as well as general manager of the Edin Div. The firm also plans to open sales service offices in Los Angeles, Chicago, Dallas and New York.

Ultrasonic clinic helps Vermont scan industry

Vermont was able to assess ultrasonics as an industrial tool during an Ultrasonics Clinic held at Springfield, Vt., April 15. The Vermont Bureau of Industrial Research sponsored the meeting, which included talks, discussions and demonstrations.

Argonne exhibits at World's Fair

The Argonne National Laboratory is displaying atomic age "tools" at the World's Fair in Brussels, Belgium, which opened April 17. Six Argonne scientists, engineers and technicians have been assigned to supervise two major exhibits from the atomic research center near Lemont, Ill.

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lightweight cold drawn cylinders for oxygen and other high pressure gases

Hackney gives you everything you want in high pressure gas cylinders—light weight, safety, minimum maintenance, long life—because the *Hackney* cold drawn process eliminates excess material and results in lighter weight, ruggedly built cylinders.

HACKNEY FEATURES INCLUDE:

- maximum strength without needless weight
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- smooth surfaces—free from crevices, ridges
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- shapes and sizes for all service requirements—from small medicals to 220's and 250's (cu. ft.) for oxygen, hydrogen, nitrogen, helium, argon and carbon dioxide

WHEN YOU BUY HACKNEY CYLINDERS, YOU:

- save money on shipping costs every time you ship cylinders
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- can have personal markings on cylinder and neck ring

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TOPS IN MY BOOK, JIM! CAN'T SEE HOW WE DID SO LONG WITHOUT IT.
WE'VE ELIMINATED A REAL PRODUCTION BOTTLENECK BY GROOVING FOR WELDING IN BETTER THAN HALF THE TIME IT USED TO TAKE.
SEE THAT SMOOTH, EVEN GROOVE? ONE PASS USUALLY DOES IT, AND WE DON'T DAMAGE THE PARENT METAL ON EITHER SIDE.
WHAT'S THE NEXT STEP?
NOTHING... IT'S READY NOW FOR WELDING.
LOOKS LIKE WE'RE REALLY GOT SOMETHING!
YOU SAID IT.... SIMPLICITY PLUS! CHEAP TO OPERATE, TOO! USES ORDINARY SHOP AIR AND CURRENT FROM ANY STANDARD WELDER, AND YOU KNOW, ARCAIR WORKS ON ANY METAL!
SEND FOR THE FREE CASE HISTORY BOOKLET TODAY!
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Brown heads NEMA's Arc Welding Section

New chairman of the Arc Welding Section of the National Electrical Manufacturer's Association is Robert T. Brown, Metal & Thermit Corp. He replaces F. A. Kaufman, who recently resigned from the McKay Co. to join Universal Cyclops Steel Corp. L. D. T. Berg, Air Reduction Sales Co., was elected vice chairman of the section and R. W. Raney takes over as chairman of the publicity committee.

Other committee chairman named at the recent Chicago meeting are: Membership, T. P. Champion, Champion Rivet Co., federal and military specifications of arc welding electrodes and filler wire, J. E. Norcross, Arcos Corp.; color markings and standards for electrodes, E. B. Lutes, Air Reduction Co.; statistical, E. J. Brady, Alloy Rods Co., arc welding booklet, R. D. Thomas, Sr., Arcos Corp.

Reid Avery Co., Baltimore, joined the section, while Ampco Metals, Inc., Milwaukee, and Wisconsin and Pacific Welding Alloys Mfg. Co., Los Angeles, resigned.

Seminar to study production costs

How to reduce production costs through welding is the theme of the National Welding Seminar, Toronto, June 2 through 6. A detailed comparison of costs betweeen manual, submerged-arc and inert gas methods will occupy one period. Latest trends to welding automation, including the use of positioners, will be considered as a saving potential.

To start the program, a session will provide practical tips on how to take home information gleaned from the seminar.

The first day will deal with basic structure and properties. Under the heading "Steel phase changes," another period will take a look at heat treatment of carbon and alloy steels and the heat-affected zone in weldments. The final first-day session covers weldability and notch toughness.

"Designs for welding" will occupy the second day. Design trends in welded fabrication of pressure vessels is one area to be dealt with. New developments in electrodes, bringing better deposit quality and higher deposition rates will be handled under "Material for welding." The final day will feature round table discussions of "Responsibility of the welding operator," "Organization and training of welding staff," and "What is a welding engineer?"

Jefferson addresses Hartford AWS section

T. B. Jefferson, editor and publisher of WELDING ENGINEER PUBLICATIONS, INC., used slides to convince his audience that more welded steel structures should be used in the construction field. He delivered a talk, "Structural Welding," to the Hartford Conn. section, of the American Welding Society.

Breese Burners assets bought by Controls Co.

Controls Co. of America, Chicago, has purchased assets of Breese Burners, Inc., Santa Fe, N.M. This includes laboratory equipment, materials, designs, products and patents. The Breese company specializes in oil burning devices, including welding torch lighters.

Stackpole Carbon gets first western plant

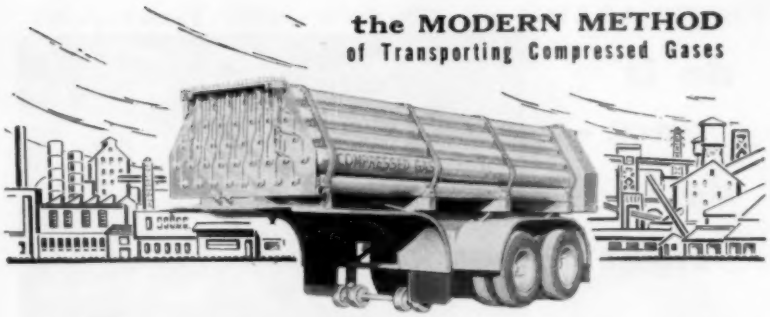
Chatsworth, Calif., in the San Fernando Valley, will be the site of Stackpole Carbon Corp.'s first new west coast plant. The St. Mary's, Pa., firm plans a 30,000 sq ft building, and will employ about 150 to produce its small electronic parts, volume controls and high altitude motor components.

NYU offers summer engineer courses

Three programs designed for practicing engineeers will be offered by New York University's college of engineering this summer. The week of June 9 "Materials for nuclear reactors" will be offered. An annual course in "Vacuum metallurgy" will be given the week starting June 23, and the college of engineering's Titanium Meeting will take place Sept. 8 and 9. The program this year will cover alloying and heat treatment. A panel discussion on the current status of the titanium industry is scheduled for the evening of Sept. 8.

High Voltage reports record sales, earnings

The sharpest sales and earnings gains in the company's 11-year history were recorded in 1957, High Voltage Engineering Corp. reports. Sales for the year ending Dec. 31 were $4,894,074, a 74% gain over the previous year. Income after taxes rose to $330,435; 97% above 1956.



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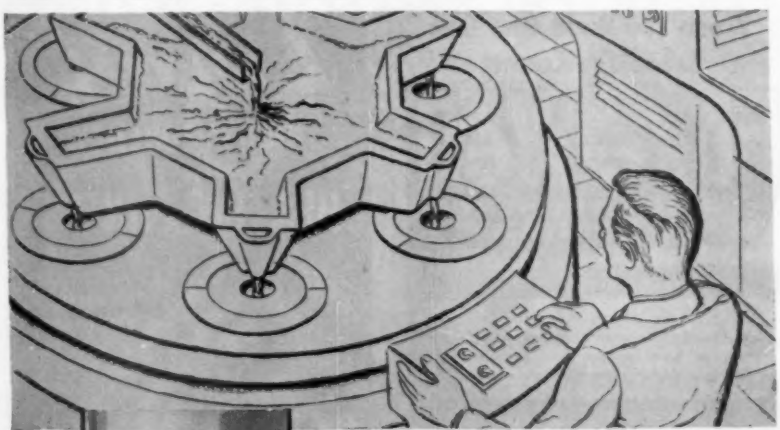

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New continuous casting of United Phoson and Sil-Bond alloys now results in the most uniform — homogenous — brazing alloys available. This technique assures more uniform results, speeds up production, reduces finishing requirements . . . for you! Always specify United homogenized alloys . . . certified to meet all standard specifications.

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Accuracy in cutting or beveling saddles, tees, els, or other designs has long been a time-consuming, trial-and-error process in pipe fabricating. Today, however, you can produce *precise* cuts and bevels *the first time*—with an H&M Shape Cutting Attachment!

The H&M Shape Cutter is actually steered around the guiding template by exerting the proper spring tension on the sliding torch assembly. The cutting torch is thereby *forced* to reproduce the exact shape desired.

Eliminate those costly "re-cuts" and "re-fits" with an H&M Shape Cutter. Then—do it once, and you've done it right!

FULL DETAILS AVAILABLE IMMEDIATELY

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FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

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FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

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FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

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HIGH FREQUENCY *Induction* HEATING UNITS

BRAZING
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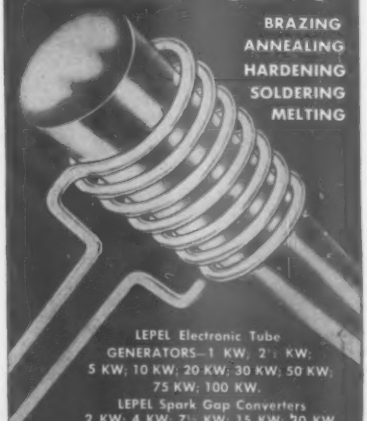

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COMING EVENTS

MAY 2: Fifth Annual Conference for Engineers and Architects, Ohio Union, Ohio State University, Columbus.

MAY 5-8: Fourteenth Annual Convention, National Welding Supply Association, Americana Hotel, Miami Beach, Fla.

MAY 12-16: Southwestern Metal Exposition, State Fair Park, Dallas.

MAY 15-16: Third Annual Welding Exposition, Utah State University, Logan, Utah.

JUNE 2-6: National Welding Seminar, Wallberg Memorial Building, University of Toronto, Toronto, Ont.

JUNE 16-18: Compressed Gas Association meeting, Seaview Country Club, Absecon, N. J.

JUNE 30-JULY 1: Independent Oxygen Manufacturer's Association convention, Poland Spring, Maine.

SEPT. 8-10: Canadian Section, Compressed Gas Association meeting, Seigniory Club, Montebello, P.Q., Canada.

U.S. Steel Supply opens new warehouse

U.S. Steel Supply Div. of United States Steel Corp. will open a steel warehousing operation in Birmingham, Ala., on May 1.

Vickers' Electric holds 1958 sales meeting

About 50 persons attended Vickers Inc's Electric Products Div. 1958 sales meeting held at the Claridge Hotel, St. Louis, recently. Attending were district office managers and supervisors, district sales engineers and representatives, product sales and service managers and representatives of engineering, management and advertising.

Farrell celebrates golden anniversary

Marking a half-century of truck tank manufacturing, Farrell Mfg. Co., Joliet, Ill., held a banquet for its 125 employees recently. Sixteen men, all with the firm 30 years or more, were honored.

Besides fuel transport equipment, the firm fabricates steel, stainless steel and aluminum pressure vessels and special tanks used in the manufacture of chemicals, paints and processed foods.

Distributor Appointments

Olin Aluminum, New York City: A. M. Castle & Co., Chicago.

H. L. McElhoe, formerly southern district manager of Smith Welding Co., is now director of training. He conducts "creative selling" meetings for the firm's distributors.

***F. R. Cruse* has been appointed sales manager of the Stainless Processing Div. of Wall Colmonoy Corp., Detroit.**

Newly named regional managers of the NCG Div. of National Cylinder Gas Co. are *A. G. Scherrer*, N. Bergen, N.J., northeastern; *F. E. Cain*, Cleveland, north central; *H. H. Comstock*, Chicago, midwestern; *Gardner L. Reynolds*, Atlanta, southeastern; *Paul E. Smith*, Dallas southwestern; *C. E. Reese*, San Francisco western.

Vice-president, gas products of Linde Co. is *William B. Nicholson*. He has been with the parent company, Union Carbide Corp., since 1935.

C. B. Armstrong, recently retired after 37 years with Air Reduction Sales Co., is succeeded as zone manager, railroad sales in the eastern region, by *Fred S. Downs*. A railroad sales representative, Downs has been with the firm since 1935.

Moody

Colt

N. F. Moody has been named district manager, Philadelphia and *H. F. Colt, Jr.* is new district manager, Boston, of Air Reduction Sales Co. Moody replaces *E. B. Walker* who is retiring after 34 years of service. Colt replaces Moody.

THEY LOOK ALIKE...

BUT THERE'S A BIG DIFFERENCE INSIDE

. . . AND THE BIG DIFFERENCE INSIDE ACETYLENE CYLINDERS IS COYNE'S SPECIAL FORMULA MAGIC MONOLITHIC FILLER. THERE'S ALWAYS GRADE A QUALITY INSIDE EVERY COYNE CYLINDER—LET US PROVE IT.

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IN STEEL You Can Be Ready for Anything! . . . Production or Emergency Repair with ALL-STATE 2 ELECTRODES!!!

Pair-up No. 275 with STEELARC®

Easiest Steel Electrode to Use and nearest to a "one rod supply for mild steel welding." Enables pass on pass without wire-brushing or chipping.

Master Craftsmen say:

"Weld anything in the steel field with All-State No. 275 and get highest tensile of any rod on the market." This chromium-nickel electrode is considered by many to be their "problem-solving rod" for all steels that are normally hard to weld.

IMPORTANT FEATURES OF BOTH NO. 275 and STEELARC®

Both AC-DC. Both low, low amperage—starts at 40. Both especially coated to transfer less heat into base metal. Both deposit faster— speed up production, get the job done sooner, do away with a lot of warpage. Both are top-o-the-heap for work on steel.

With these and other advanced All-State Alloys

GOOD WELDORS DO BETTER

Select right alloy,
Use it right,
Do your best work on **STEEL**

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Seamless and stoutly reinforced with new plastic, ratchet headgear. Easily adjusts to any headsize.

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NEW DESIGN ADVANTAGES

1. Lighter weight.
2. Smoother, easier to clean.
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The complete one-order supplier for you!
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Ornamental Iron Finish—a plastic-base paint especially developed for painting ornamental metal work. Costs no more than ordinary metal paints. Money-back guarantee. Colors: Gloss Black, Satin Black, White, Primrose Yellow, Natural Gray, Warm Gray, Green.

50-gal. drum.....$4.26 per gal.
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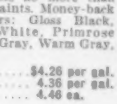
"CS" Welding Electrodes—Specially designed for welding cast iron to steel or cast iron to cast iron. Clean spatter-free welds! Costs less than other rods for welding cast to steel!



1/8 x 14" (25 lb. box)....lb. 87¢
5/32 x 14" (25 lb. box)....lb. 81¢

TFC Metal Primer—A superior homogenized primer . . . will not lift or bleed. Excellent coverage. Fully rust-inhibitive. Red or Black.

5-gal. cans.....$3.15 per gal.
1-gal. cans.....3.26 ea.
50-gal. dr.....3.05 per gal.

All Prices F.O.B. Memphis

Tennessee Fabricating Co.
1239 Grimes St.
Memphis, Tenn.

TFC

Please enter our order for:

☐ **SEND FREE 32-PAGE CATALOG**
Includes more than 400 casting designs

Name.....
Address.....
City.....State.....

New general manager of Burdett Oxygen Co.'s plant in Dayton, Ohio is *William Kaiser*. Succeeding him as manager of the warehouse in Mansfield, Ohio is *Jack Harris*, a member of the sales division in Cleveland. *Robert Kimmerle* will handle Harris' sales duties in Elyria, Lorain and the northeastern section of Cleveland.

Vice president in charge of Colmonoy Div. operations of Wall Colmonoy Co. is *Elmer J. Lell*. His office will be in Detroit.

J. M. Crockett has been appointed manager of the Birmingham (Ala.) District of Air Reduction Sales Co. He replaces *W. L. Poole*, who has been named sales consultant for the Birmingham district.

Donald T. O'Shea has been named general sales manager of American Industrial Safety Equipment Co., Cleveland.

***William Guy* is assistant chief engineer of Harris Calorific Co., Cleveland. He was with Aro Equipment Corp., Cleveland.**

Ludwig Zengeler has been named a vice president of the NCG Div. of National Cylinder Gas Co., Chicago and *William T. Dellinger* succeeds him as general superintendent of NCG industrial gas producing plants.

Lloyd C. Fitzgerald has been promoted to sales manager for the Chicago district supply division of U. S. Steel Corp., Chicago.

Hugh Brunner has been named to the newly created post of assembly plant manager of Square D Co., Cedar Rapids, Ia.

Died . . .

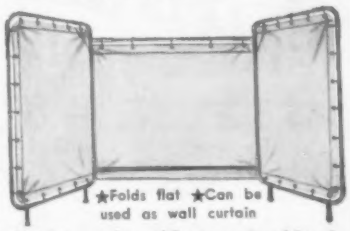
Roy Henry Glover, 67, board chairman of Anaconda Co., died recently in Washington.

Fred A. Aston, Sr., retired sales manager, national accounts for Oakite Products, Inc., died recently in his Florida home. He was 79.

A. L. Hawk, sales executive of the Manhattan Rubber Div. of Raybestos-Manhattan, Inc., Passaic, N.J., died of a heart attack on March 21. He was 47.

PORTABLE SINGER SCREEN

The only screen of its kind!



★Folds flat ★Can be used as wall curtain

★Light weight ★Rust-proof ★Sturdy
★Assembles in 5 minutes—no threads

AT LAST — a portable screen that is a fraction of the weight of the old type. Withstands rough handling. Available in every wanted size. Ask your dealer or write to us:

Special Products Division

SINGER GLOVE MFG. CO.

860 West Weed Street
CHICAGO 22, ILL.

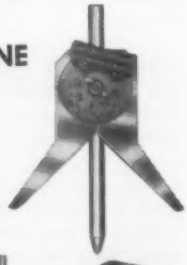
NEW 16 PAGE CATALOG
Complete line of work gloves for every job, safety clothing and welders gloves.

See our ad in WELDING DIRECTORY

Really FIVE TOOLS in ONE

Yes, actually a BOYCE Centering Head replaces

✓ The Protractor
✓ The Centerhead
✓ The Center Punch
✓ The Level
✓ The Scale



Determines Center Line at any Degree and Measures Degree of Declivity

Weighs only 9 ozs. Pocket size.

DIAL SET LEVEL

Y type head accurately machined with tangents and tips for centering and aligning. Dial Set Level in graduations of 2½ and 10 degree markings. Punch of Drill Rod with hardened point—insuring long service. Send for complete description.

CONTOUR MARKER CORP.
1843 E. Compton Bl., Compton, Cal.
Also Mfgs. of Contour Markers, Radius Markers and Pipe Flange Aligners.

BOYCE CENTERING HEAD

SHOOT-A-LITE

SAFETY GAS LITER

The Practical Lighter for welding and cutting torches

SAFE! SURE! STRONG!

Ask your jobber or write us.

SHOOT-A-LITE CORPORATION

110 Washington St. • Dept. WE

New York 6, N. Y.

TILLMAN

Gloves—Garments

WELDORS BUY FROM YOUR DEALER

ASK FOR OUR NEW CATALOG

BRAZILIAN DEERSKIN
THE "STAY SOFT" LEATHER
GLOVES AND MITTENS

TILLMAN PRODUCTS

John Tillman & Co.

Long Beach, Calif.

30 YEARS AGO

(Taken from *The Welding Engineer* of May, 1928)

President F. M. Farmer reviewed the progress made during the 9th year of the existence of the American Welding Society at its annual spring meeting last month. New president is F. T. Llewellyn, U.S. Steel Corp.

—30 YEARS AGO—

Vital parts of Ford plane welded, headlines an article. But welding of duralumin presents a problem, because the welded joint is unusually subject to corrosion, Stout Metal Airplane Co. reports. The division of Ford Motor Co. is the first to manufacture airplanes on the assembly line.

—30 YEARS AGO—

An hour after the St. Francis Dam gave way, gushing 12 billion ft of water into California's Valley of Santa Paula, weldors were on the job repairing main gas lines. In six hours Southern Counties Gas Co. weldors relaid 950 ft of 6-in. pipe, effected a river crossing and restored the flow of gas.

—30 YEARS AGO—

Victor Oxy-Acetylene Equipment Co. of San Francisco has placed E. A. Daniels in charge of all pipe line refining activities. He was formerly in charge of welding operations at the Avon, Calif., refinery of Associated Oil Co.

—30 YEARS AGO—

The Hobart Brothers Co., Troy, Ohio, well known manufacturers of electrical equipment, recently added two types of portable electric arc welders to their line.

—30 YEARS AGO—

On March 28 the Linde Air Products Co. opened a new district sales office in Memphis, Tenn.

—30 YEARS AGO—

W. A. Slack, president of the Torchweld Equipment Co., will address the National Supply and Machinery Distributors' Association at its 23rd annual convention this month.

—30 YEARS AGO—

Underwater cutting played an indispensable part in the salvaging of the U.S. submarine S-4. Within 24 hours after the S-4 was sunk outside of Provincetown, Mass., the Navy was asking for experienced underwater torch operators.

WELDING GALVANIZED?

Then galvanize your welds with

Galvalloy

GALVALLOY is BEST because

- it bonds quickly
- it bonds permanently
- it bonds to most metals
- it withstands 30 day salt test

GALVALLOY is EASIEST TO USE because

- it melts at a higher temperature
- less than 1/5 as much required
- it covers 60-70 ft.of weld per lb.
- it will not burn from excess heat

EASY TO APPLY

MERELY PREHEAT

THEN RUB ON

AVAILABLE AT YOUR WELDING SUPPLY DISTRIBUTOR OR WRITE

METALLOY PRODUCTS CO.
1233 S. BOYLE AVE., LOS ANGELES 23

Welding Hose and Cable Reels

INLAND STEEL COMPANY'S Chicago Heigths, Illinois, mill has installed WELDREEL reels in their rolling department where plate is cut to size. Here, with the strictest safety precautions being observed, the area is kept free of cutting torch hose except when it is in use.

The WELDREEL MODEL OA-A units retract the hose onto strong spring powered reels, and permit it to be paid out easily as needed. Hose life is greatly extended—plant operations are made more efficient—better, safer housekeeping is maintained.

WELDREEL reels are available with capacities from 40 to 150 feet of dual hose and up to 100 feet of cable.

UNITED SPECIALTIES, INC.
P. O. BOX 698 EL DORADO, ARKANSAS

a NEW product means NEW time saving and important NEW production gains

York's
SPAT-R PRUF COMPOUND 106

don't sputter about spatter . . .
JUST WIPE IT OFF

Completely eliminates grinding after welding. Just one coat, and spatter can be wiped away with a dry cloth.

- NO STIRRING OR DILUTION
- NON-TOXIC
- NON-INFLAMMABLE
- NO ODOR
- HARMLESS TO SKIN
- PERFECT PAINT BASE
- HELPS PREVENT RUST
- NO WELD POROSITY

Available 1 or 5-gal. cans, 55-gal. drums

3 in 1 York's '77'
SPECIAL FLUX
FOR GENERAL BRAZING
FOR CAST IRON WELDING
FOR CAST IRON BRAZING

YORK ENGINEERING COMPANY
2711 S. Kedzie Ave. Chicago 23, Ill.

free literature..... *USE CARD ON PAGE 97*

51. HARDFACING — The McKay Co. Hardfacing catalog details range of electrodes and wires. A guide on hardfacing with welding electrodes and automatic or semi-automatic wires.

52. ARC WELDING—Tweco Products, Inc. No. 11 Twecolog illustrates and describes line of arc welding cable connections and accessories.

53. BENCH WELDER — Graham Mfg. Corp. Specifications of model X-8000 automatic bench welder given on illustrated page.

54. INSTRUCTION MANUAL—All-State Welding Alloys Co., Inc. 52-page book gives instructions for weldors, covers 62 specialty alloys.

55. PRESS—Precision Welder & Flexopress Corp. Bulletin AFP-101 gives details of line of high-speed presses; includes specifications, explains ball bearing ram raceways.

56. BERYLLIUM—The Beryllium Corp. Booklet covers all phases of beryllium metal, includes tables of physical, mechanical properties and analysis of grades.

57. ULTRASONIC WELDING—Sonobond Corp. Bulletin SW-87 tells of ultrasonic welding without fusion. Covers engineered production equipment for welding.

58. COPPER—The Anaconda Co. Publication B-36R is revised edition of "Corrosion resistance of copper and copper alloys," a 32-page reference booklet.

59. BONDING MATERIAL — Technion Design & Mfg. Co., Inc. Two-page technical report 114 on "Epoxweld 100" preforms, includes typical applications.

60. RESIDUAL STRESSES—LaSalle Steel Co. 32-page pocket-size book, "Residual stresses in cold finished steel bars and their effect on manufactured parts," covers stresses in cold drawn, ground, turned and heat-treated steels to fatigue, cracking, machinability, tolerances and corrosion.

61. HANDLE CLAMP—Erico Products, Inc. Handle clamps are featured on illustrated page.

62. BRAZING ALLOY—United Wire & Supply Corp. Low temperature silver alloy brazing described in 7-page bulletin. Includes engineering facts and data.

63. ARC WELDER—Brennen, Bucci and Weber, Inc. Portable, 65-lb arc welder detailed in folder. Includes features, specifications.

64. GAS GUN—Velocity Power Tool Co. Automatic on-off air acetylene gas gun for soldering, sweating, brazing, pre-heating, melting and maintenance detailed in illustrated folder.

65. ELECTRON TUBES—Amperex Electronic Corp. Electron tubes and semiconductors fully described in 28-page book. Includes specifications.

66. HEATER—Arthur S. LaPine & Co. Electrothermal armored heater used to normalize welds is told about in bulletin.

67. HARDFACING—Kennametal, Inc. Test of tungsten carbide hardfacing material is told of in single page.

68. ARC WELDER—Caterpillar Tractor Co. Form D761, an 8-page, two-color booklet, "Seven keys to welding profit," covers uses of twin arc-welder. Book stresses reliable power, two steady arcs, dual controls, etc.

69. MACHINE MODELS—Commodex Corp. Booklet covers construction system for making working models of machines.

70. SAFETY SHOES—Lehigh Safety Shoe Co. 17-page catalog lists details on 72 different safety shoe styles for men and women; includes buying guide.

71. HEATING UNITS—Westinghouse Electric Corp. Industrial electric heating units featured in booklet 27-620. Covers bolt heaters, strip heaters, etc. Problems and solutions discussed with aid of graphs and charts.

72. RECTIFIERS — Allis-Chalmers Mfg. Co. Line of semi-conductor rectifiers described in bulletin 12B8897. Includes germanium, silicon and selenium rectifiers.

73. GAS WELDING—Modern Engineering Co. Revised 36-page welding equipment catalog No. 160 covers applications of line of oxyacetylene welding and cutting torches, air-acetylene torches, machine cutting torches, etc.

74. BONDED FLUX—Arcos Corp. New 4-page folder shows effect of bonded flux on stainless and low alloy steel submerged arc welds. Demonstrates effect of varying weld speed, current, voltage or flux burden.

75. LIMITING BRAZING—Wall Colmonoy Corp. Two-color engineering data sheet 14 describes "Stop-off" material for controlling alloy flow. Gives function, use, properties and solvent.

76. ELECTRICAL CONTROLS—Assembly Products, Inc. All-purpose electrical controls covered in 12-page bulletin 106. Explains applications of automatic and limit controls.

77. BLAST CLEANING — Wheelabrator Corp. 32-page illustrated catalog 951-D covers line of airless blast cleaning machines and wet blast, air blast and dust control equipment.

78. CERAMIC PARTS—Sylvania Electric Products, Inc. "Precision ceramic parts for industry" describes fabrication of precision ceramic parts and vacuum-tight ceramic-to-metal composites.

CLASSIFIED EMPLOYMENT • BUSINESS • THE WELDING SHOPPER OPPORTUNITIES ADVERTISING • EQUIPMENT—USED and RESALE

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(Not available for equipment advertising) 90c a line, minimum 6 lines. To figure advance payment, count 5 average words as a line.

INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rate; minimum $5, payable in advance.

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BOX NUMBERS count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $8.75 per inch for all advertising appearing on other than a contract basis. Maximum size of display ad is 4 col. in. Contract rates quoted on request. AN ADVERTISING INCH is measured ⅞ in. vertically on one column, 3 columns—30 inches—to a page.

CONSULTING SERVICE

OXYGEN-NITROGEN-ARGON, THE TREASURE OF ATMOSPHERIC AIR, ACETYLENE PLANTS

Consulting Construction Engineer for Air Liquefaction.

Servicing & installation of new oxygen-nitrogen, gas or liquid production, automatic & standard acetylene plants. Inspection & advice for reconditioning old plants, any system European or U.S.A. equipment, with up to date modern technique.

Proper training of operators for safety & successful economical operation. Excellent teacher for gas welding, cutting & brazing.

Experienced for over ⅓ century in 5 continents of the world. Have constructed plants from start to finish including foundation, building, power supply & etc., under difficult circumstances & they have proved satisfactory for the governments of the U.S.A., S.A., European & Private Enterprise. Able to build plants anywhere, even in a remote outpost.

Investigation of explosive damage in this industry, arbitrator for the court and investigator for Insurance Companies.

INDUSTRIAL GAS, P.O. Box 876, Clearlake Highlands, Calif., Phone: Lower Lake 5891

SITUATION WANTED

Can you use 18 years welding experience?

Welding sales & Service
Welding instructor
Welding supervisor
Practical Welding Eng.

Familiar with all kinds of automatic and manual welding

Desires to relocate in South or Southwest
For complete resume:

HARRY LANE
4105 S. Wayne Ave. Ft. Wayne, Ind.
Phone: HArrison 5-0854

EQUIPMENT FOR SALE

150 KVA TAYLOR-WINFIELD FLASH BUTT WELDERS

Model B-9-30 for Hand Upsetting; 400 volts. Capacity 1" round

H. H. PELZ MACHINERY CO.
549 Washington Blvd., Chicago 6, Ill.
Phone: ANdover 3-5811

EQUIPMENT REPAIR

SAVE YOUR OLD CUTTING TIPS

Send us your worn-out Oxygen-acetylene or propane cutting tips—For a fraction of the cost of a new tip, we'll make those "Worn-Out" tips **GOOD AS NEW.**

Each tip will be Reseated, Redrilled, Refinished and flame tested . . . then returned to you—Ready to give you the same service as a new tip.

Your cost for this service: Only $1.25 ea. Over 100 at $1.00 ea. Terms: 2% 10 days.

We condition tips of any style or make.

Send us a trial box of tips today—Satisfaction GUARANTEED.

AMEROTIP COMPANY
"PROMPT APPARATUS REPAIR SERVICE"
1811 Taylor St., Dept. C Columbia, S. C.

EQUIPMENT FOR SALE

WELDING PLATENS

STAHL EQUIPMENT CO.
94 Washington St. Brookline 46, Mass.

1200 lbs. brand new (manufactured in August, 1957) 3/16" Coated Stoodite AC-DC hard surfacing electrodes. Current Stoody price $2.70 per lb. Make us an offer.

Al Earlbeck Earlbeck & Landurm, Inc.
1023 Cathedral St. Baltimore 1, Maryland
Phone: MUlberry 5-8511

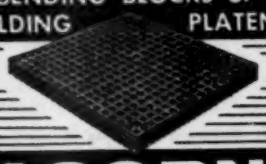
HEAVY DUTY TURNING ROLLS
for rotating pressure vessels, pipe and cylindrical bodies for welding

Aronson MACHINE CO., ARCADE, N.Y.

A COMPLETE LINE of WELDING POSITIONERS

CUTTING MACHINES, AIRCO Camo & Radiagraphs and NATIONAL No. 5.
SEAM WELDER, Progressive, 150 KVA, New.
SPOT WELDER, National, 40 KVA, Used.
CUTTING TORCHES, Used, Oxweld, Airco, Harris.
WELDING TORCHES, New, Rego GV.
BRONZE—STAINLESS—AMPCOTRODES.
ELECTRODE HOLDERS.
RALL SUPPLY CO. 51 E. 42nd St., N.Y.C. 17

ACORN
BENDING BLOCKS or WELDING PLATENS



ACORN
IRON & SUPPLY CO.
901 N. Delaware Ave., Phila. 23, Pa.

SCHOOL

WELDING—A profitable trade. Demand for trained men. Learn quickly at best equipped school in U. S. Non-profit. G. I. approved. Catalog free. Write: Hobart Welding School, Box U-581, Troy, Ohio.

WANTED TO BUY

WANT TO BUY—USED—12,000 to 16,000 lb. variable speed Welding Positioner.

TUPES OF SAGINAW, Inc.
402 Davenport Street
Saginaw, Michigan

BUSINESS OPPORTUNITIES

A NICE REPEAT BUSINESS
JOBBERS WANTED IN EVERY CITY TO SELL "WELDER'S PAL" EYE DROPS
On the market for 20 years
CARHOFF COMPANY
11706 Kinsman Rd., Cleveland 20, Ohio

WHERE TO BUY

9314 Berenice (Schiller Park), Chicago, Ill.

"Jorgensen" and "Pony"

CLAMPS

Write for free 32-page complete line catalog

Sold through leading distributors

Adjustable Clamp Co.
"the clamp folks"
426 N. Ashland Ave. Chicago 22, Ill.

Adjustable Clamp Co. 95
Air Reduction Sales Co. 17, 67
Alloy Rods Co. 21, 77
All-State Welding Alloys Co., Inc. 91
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Worthington Corp. 15

York Engineering Co. 94

Literature offered in ads

125. Adjustable Clamp Co. — Catalog available on complete line of "Jorgensen" and "Pony" clamps.

126. Air Reduction Sales Co.—Write for catalog 1318, "Airco Electrode Guide."

127. Air Reduction Sales Co.—Information available on the new Airco natural gas torches, also data sheets, cutting charts and operation manual.

128. Alloy Rods Co.—Write for bulletin AR-10-2, "The Arcaloy Selector Guide."

129. Alloy Rods Co.—Bulletin HS-102 gives complete details on the "Wear-O-Matic" wire feed unit.

130. All-State Welding Alloys Co., Inc. —Folder on "Steelarc" electrodes available.

131. Aluminum Co. of America—Further information, books and films available on joining aluminum.

132. American Brass Co.—For an easy repair method for cast iron, send for a copy of Publication B-13.

133. American Manganese Steel Div.—Write for "Nicro-Mang" bulletin, on a new welding rod to help you solve the cracking problem.

134. American Messer Corp.—Write for full details on the Messer cutting machines.

135. American Optical Co.—Write for further information on the flexible mask goggles.

136. American Platinum & Silver Div.—"A Complete Guide To Successful Silver Brazing" and "A Complete Guide To Selective Fluxing For Low Temperature Silver Brazing" are available.

137. Ampco Metal, Inc.—Send for Bulletin W-17, on Ampco bronze weldrods.

138. Arcair Co.—Case history booklet available.

139. Aronson Machine Co.—Detailed engineering data available on Aronson's positioners.

140. Atlantic Abrasive Corp.—Write for Atlantic Abrasive catalog.

141. Atlas Welding Accessories, Inc.—Further information available on the Atlas line of weld cleaning tools.

142. Belden Mfg. Co.—Data available on Belden's engineered welding cable.

143. Bernard Welding Equipment Co.—Write for further information on the "Shortstub" electrode holder.

144. Burdett Oxygen Co.—Write for further details on "Burdox" industrial gases and welding and cutting equipment.

145. Carol Cable Div.—Information on "Dynapower" welding cable available.

146. Chicago Hardware Foundry Co.—Information on "Fuse-Well" cast-iron welding rods and electrodes are available.

147. Contour Marker Corp.—Information and instruction book on laying out pipe joints.

148. Contour Marker Corp.—Details on establishing and marking a point at any angle.

149. Coyne Cylinder Co.—Write for details on Coyne Acetylene Cylinders.

150. Duro Engineering Co.—Write for further information on Duro's standard holder and the new "Durogon" holder, also for name and address of nearest distributor.

151. Fibre-Metal Products Co.—Write for bulletin 65 on the "SuperGrip" electrode holder.

152. Flood Safety Products Co.—Further information available on fiber glass helmets manufactured by Flood, and other welding and safety equipment.

153. Goldsmith Bros. Smelting & Refining Co.—For complete information on low temperature silver brazing write for a copy of the GB data book.

154. H & M Pipe Beveling Machine Co.—Full details available immediately on the H & M shape cutter.

155. Handy and Harman—Bulletin 20 explains the values, techniques and economics of low-temperature silver brazing.

156. Harnischfeger Corp.—Write for further information on the new P&H engine-driven welders.

157. Harnischfeger Corp.—Bulletin R-29 available on iron-powder electrodes.

158. Harnischfeger Corp.—Low-Hydrogen electrode bulletin available.

159. Harrisburg Steel Co.—Further information available on gas storage.

160. Harris Calorific Co. Write for more details on the Gaugeless regulator.

161. Hobart Brothers Co.—Electrode catalog available and information on Hobart's line of arc welders.

162. Hobart Brothers Co.—Complete information available on the new Hobart Welder-Power combination.

163. Independent Engineering Co.—Further information available on transporting compressed gases by gas supply trailers.

164. International Nickel Co. Inc.—"A Handy Guide to Welding Cast Irons" illustrates the many different repair jobs you can do with Ni-Rod "55" electrodes.

165. Invincible Vacuum Cleaner Mfg. Co.—Write for folder on all types of flux recovery systems.

166. Jackson Products—Write for complete information on Jackson's head and face protection equipment for your weldors.

167. Lenco, Inc.—Further information available on "Hi-Amp" electrode holders.

168. Lepel High Frequency Laboratories, Inc.—Catalog on high-frequency induction heating units for brazing, annealing, hardening, soldering and melting.

169. Lincoln Electric Co.—Further information on the "Mechanized Squirt Welder" is available.

170. Linde Co.—Write for further information on Lindes guaranteed inert argon welding gas.

171. Linde Co.—Write for catalog F-4487 on the complete line of "Oxweld" portable cutting machines.

172. Linde Co.—Catalog available on "Purox" welding and cutting equipment.

173. Linde Co.—Information on "Prest-O-Lite" air acetylene outfits.

(Continued on page 98)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 74 to 86

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

USE POSTPAID CARD →

★ For copies of any manufacturers' bulletins described on these pages, circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers and the items that interest you. The New Products section begins on page 74.

WARNING!

Illegible or incomplete addresses may keep you from receiving the information you desire. And remember, cards postmarked after the deadline date cannot be processed.

★ Post card not valid after three (3) months. After that time has elapsed, use your own letterhead to describe fully the information and/or literature wanted.

Name_____ Title_____

Company_____

Address_____

City_____ State_____ 5/58

NOT GOOD AFTER AUGUST 1, 1958

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Literature offered in ads

(Continued from page 96)

174. Liquid Carbonic—Complete technical data available on CO_2 shielded gas welding.

175. Magnaflux Corp.—Write for new bulletin on Magnaflux scientific inspection service.

176. Manhattan Rubber Div.—Data available on Manhattan's reinforced "Cut-Off Wheels".

177. McKay Co.—Write for the new McKay "Hard Surfacing" catalog.

178. Merrill Brothers—Information on lifting clamps, twin and drum lifters, drum tilters and other material-handling devices.

179. Metal & Thermit Corp.—For reference material prepared to aid you in your stainless welding operations write for the "Murex Stainless Fact File".

180. Metalloy Products Co.—Write for further information on "Galvalloy" to galvanize your welds.

181. Miller Electric Mfg. Co. Inc.—Complete information available on Miller's "Gold Star" transformers, weld stabilized circuits and semimetallic rectifiers.

182. National Carbide Co.—Information on calcium carbide available, also name and address of nearest supplier.

183. National Welding Equipment Co.—Booklet available "you don't need an egg beater to mix gases."

184. Norris-Thermador Corp.—Write for specifications on all sizes of Norris-Thermador's acetylene cylinders.

185. Page Steel & Wire Div.—Write for Page's "Welding Wire Comparison Chart" and a booklet on gas welding rods.

186. Phoenix Products Co.—Write for new booklet on Dry-Rod ovens.

187. Pressed Steel Tank Co.—Write for detailed facts and prices on Hackney high pressure gas cylinders.

188. Shoot-A-Lite Corp.—Literature on "Safety Gas Liter" for welding and cutting torches.

189. Singer Glove Mfg. Co.—Catalog on Singer's complete line of work gloves and safety clothing.

190. A. O. Smith Corp.—Write for further information on A. O. Smith welding machines.

191. Smith Welding Equipment Corp.—Bulletin HHP-1 on Smith's new Air-LP Gas Torch Kit, is available.

192. Square D Co.—Bulletin SM-276 available, on Square's D's new gun handle air valve.

193. Stoody Co.—Write if interested in a semi-automatic hard-facing demonstration in your plant.

194. Stulz-Sickles Co.—Data on "Manganal" bare welding electrodes and name of nearest distributor available.

195. Sylvania Electric Products Inc.—Information on color coded Tungsten electrodes.

196. Tempil Corp.—Information and sample pellets of temperature indicators; state temperature desired.

197. Tennessee Fabricating Co.—32 page catalog showing 400 casting designs available.

198. Tillman & Co., John—Write for catalog on weldor's gloves and garments.

199. United Specialties, Inc.—Complete information on "Weldreel" welding hose and cable reels.

200. United Wire & Supply Corp.—Write for booklet "Low Temperature Brazing Engineering Facts and Data."

201. Victor Equipment Co.—Write for further information on Victor's welding and cutting equipment, gas regulators, and hardfacing rods.

202. Wall Colmonoy Corp.—Write for Colmonoy Hard-Facing Manual and Spray-welder catalog, also the complete "Nicro-braz" data file.

203. Welsh Mfg. Co.—Write for further information on cushion-soft frames for comfort-fit eye protection.

204. Worthington Corp.—Further information on welding positioners available.

205. York Engineering Co.—Write for further information on the "Spat-R-Pruf Compound 106".

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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Name_____ Title_____

Company_____

Address_____

City_____ State_____ 5/58

NOT GOOD AFTER AUGUST 1, 1958

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

Please send me without obligation further information about the following:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
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For tips that save Sylvania is

the preferred electrode

Welders say they prefer Sylvania Tungsten Electrodes because they tip easily and economically. Now Sylvania packs money-saving information on tipping with every package of welding electrodes. The leaflet "How to Avoid Waste" presents methods for proper retipping which are the results of experience and research.

It's just one more reason why, more than ever, welders prefer Sylvania electrodes and why your welding supply distributor is happy to serve you with the industry's only complete line.

Remember too, that for further protection against waste Sylvania electrodes are color-coded and packed in a protective wood filler.

Ask your distributor for Sylvania next time you order.

TUNGSTEN • MOLYBDENUM • CHEMICALS • PHOSPHORS • SEMICONDUCTORS

SYLVANIA

Sylvania Electric Products Inc.
Chemical & Metallurgical Div.
Towanda, Penna.

LIGHTING • TELEVISION • RADIO • ELECTRONICS • PHOTOGRAPHY • ATOMIC ENERGY • CHEMISTRY-METALLURGY

SEE US AT THE WELDING SHOW, BOOTH 118

WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

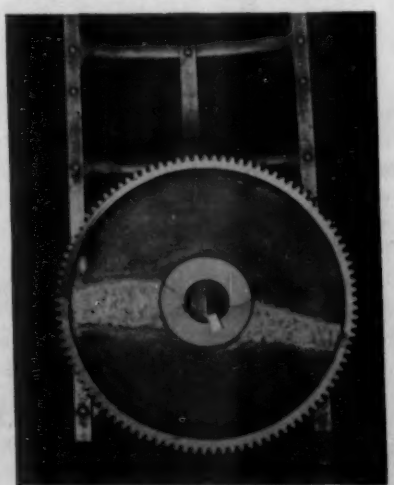
Braze Welding repairs saved this cast iron gear—and 2 to 4 weeks' production time

1. When a keyway came out and fell in the motor pinion of a big sheet mill flattener, this cast iron gear broke in half. Delivery on a new gear was 3 to 5 weeks. Braze welding repairs could return the machine to production in about a week.

2. To save production time, it was decided to repair by braze welding. The 30″ diameter gear with a 3″ gear face and 1″ thick solid web was prepared by chipping and grinding bevels on edges of the fracture from both sides. This took 11 man-hours.

3. The gear was preheated to 800 F with an oxypropane torch. Then the fracture was braze welded, and the damaged gear face built up to full diameter with Anaconda-997 (Low Fuming) Bronze Welding Rod. Total welding time, 14 man-hours.

4. After a period of slow cooling, the welded gear was ready for a trip to the mill's machine shop. Here it was trued up and new teeth were cut in the built-up bronze weld metal. This phase of the repair required only 15 man-hours.



5. The repaired gear on its way back to the sheet mill flattener in less than a week. The machine was reassembled and back in production in just one week for a total saving of two to four weeks of valuable production time.

Oxyacetylene braze welding with Anaconda-997 (Low Fuming) Bronze and Tobin Bronze®-481 Welding Rods is widely recognized as the easiest and least expensive repair method for cast iron. For full details, write for a copy of Publication B-13.

Free Technical Service. Anaconda distributors can help you select rod for most jobs. But if you have a special problem, American Brass Company specialists will be glad to help you. For this service—or a copy of the book—write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA®
WELDING RODS
made by
The American Brass Company